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ABSTRACT

A study was conducted to determine the performance levels of competencies for job entry as a data processing programer. Specifically, the study sought to answer: (1) What tasks are performed by entry level programers? (2) How frequently are these tasks performed? (3) What level of performance is necessary for these tasks? (4) How important are these tasks? and (5) What is the future projected need for these tasks? Both questionnaire and followup interviews were used. The population consisted of all data processing associate degree programing graduates at nine Wisconsin vocational, technical, and adult schools for 1973 to 1975 and their supervisors/employers. A questionnaire was developed in which respondents were asked to rate each of 75 tasks on a five-point scale relevant to four criteria: Frequency, performance, importance, and future need. Questionnaires were mailed to each of 508 graduates (one for the graduate, and one for his employer/supervisor). There was approximately 50% response. Followup interviews were conducted with 26 graduates and 21 employers to supplement and verify the data. Both graduates and employers tended to rank the four areas the same for all six groups of tasks (systems analysis and design, program design, coding, testing and debugging, documentation, and miscellaneous). Interviews indicated that many businesses are using or are considering an on-line system in the near future. It was concluded that the Wisconsin vocational, technical, and adult education system is currently emphasizing the proper tasks needed for entry-level programers. Many employers indicated that operation experience was very important to being a successful entry-level programer. (Recommendations are included and the questionnaire, interview guides, and complete findings and data analysis are included.) (LAS)

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FINAL REPORT

Federal Project No. 03-009-151-226
District No. 01-005-151-226

# DETERMINING PERFORMANCE LEVELS OF COMPETENCIES FOR JOB ENTRY OF DATA PROCESSING PROGRAMMERS

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DISTRICT ONE TECHNICAL INSTITUTE
Eau Claire, Wisconsin

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June, 1976

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# CHAPTER I

# INTRODUCTION

## Need for the Study

A research study titled "Research Priorities in Postsecondary Vocational, Technical and Adult Education in Wisconsin for 1975-77" was conducted in February, 1975. It was sent to administrative staff of the vocational, technical and adult education districts in Wisconsin and they were asked to rank forty-five (45) vocational research areas/ topics for Wisconsin VTAE. The item that ranked second was "Determining Performance Levels of Competencies for Job Entry."

At a state meeting on research and planning, a consortia of five VTAE districts were selected to study five to ten VTAE programs to determine performance levels of competencies for job entry. The districts included were Blackhawk, Waukesha, Mid-State, Southwest and District One (Eau Claire).

District One submitted two programs and from these the data processing programmer competency area was selected by the state.

The determining of entry level competencies for the data processing programmer is very pertinent at this time because of the many changes which have occurred in recent years in data processing. Our main concerns in teaching programmers should be to maintain relevancy of curriculum content, instructional processes, competencies and performance levels to be achieved. Programmers hired today are required to begin

writing programs, from the day they are hired, rather than only know some body of knowledge since emphasis is on performance.

What are the competencies and performance levels needed to be a successful entry level programmer? These things must be determined before data processing curriculum can be effectively evaluated and perhaps revised. The identification and analysis of the tasks performed by programmers is the initial step in developing efficient data processing programmer curricula.

Statement of the Problem

The problem researched in this study was a determination of the performance levels of competencies for job entry as a data processing programmer.

Specifically, the study sought to answer the following questions:

1. What tasks are performed by entry level programmers?
2. How frequently are these tasks performed?
3. What level of performance is necessary for these tasks?
4. How important are these tasks?
5. What is the future projected need for these tasks?

Purpose for the Study

The basic purpose of the study was to determine the competencies that are needed by data processing graduates so they may become successful programmers in the world of work. The study sought to obtain information that would be valuable to the vocational-technical schools in planning their curricula in data processing to better meet these students' needs. The results of the study will enable the vocational-

technical schools in the state to re-evaluate their data processing programs. The results will be used to modify or maintain existing data processing curricula.

Limitations

This study is limited by the following factors:

1. The number of questionnaires returned.
2. The data processing task descriptions used in the questionnaire are subject to varying definitions and interpretations.
3. The human element as it affects this writer and those surveyed.

Delimitations of the Study

The area studied is restricted to the two year data processing programs as approved by the Wisconsin State Board of Vocational, Technical and Adult Education. The two year data processing program is offered in nine of the state's postsecondary vocational-technical schools. For a listing of the nine districts, refer to chapter 3.

The population of this study is limited to those students who graduated from a two year data processing program in 1973, 1974, and 1975, and are employed in data processing, and their supervisors.

## CHAPTER II

## RELATED LITERATURE

Studies dealing with computer programming tasks and curricula were reviewed for information pertinent to this study.

Regular evaluations of the data processing curriculum can assist in keeping the data processing program relevant to the needs of the community in this rapidly changing technological field.

An article in the American Vocational Journal said the following about vocational teachers:

> Their job is to train people for jobs. If their instruction is to be realistic, its content and performance standards must conform to the requirements of entry-level positions in the labor market.[1]

> The objectives of vocational education is to provide any student with the necessary skills and knowledge that utilize the full potential of the student's abilities and provides the employer with an employee who is immediately productive with a minimum of retraining.[2]

A study by Raymond M. Berger presented "the results of an investigation of what in fact programmers are and do."[3] In his study, Berger

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[1]Dr. Soskis and Mrs. Keeton, "How To Stay In The Classroom and Keep Up With Job Changes," American Vocational Journal, p. 42, September, 1975.

[2]Robert M. Pesola, Sr., "Education For Employability In The Vocational School," Data Management, p. 23, December, 1974.

[3]Raymond M. Berger, Computer Programmer Job Analysis Reference Text, AFIPS, 1974, p. 1.

developed a list of tasks and skills and asked programmers across the nation to rate them in order of importance for their particular job.

Searches were made through the ERIC system and RIE for computer programmers and performance levels in data processing using appropriate descriptors. This turned up a research report called, "Business Data Processing Occupational Performance Survey."[4] Included in this report is a list of 474 tasks performed by data processing personnel, of which 164 deal directly with programming. In this "Business Data Processing Occupational Performance Survey" the following tasks were performed by over eighty percent of the programmers who responded:

> Desk check or debug programs after assembly or compilation,
> Isolate and correct programming errors discovered during testing,
> Test new computer programs,
> Code routine computer programs,
> Revise computer programs, and
> Test revised computer programs.[5]

A most recent related study completed in Wisconsin was in 1971 by John L. Moseng entitled "A Study to Determine the Importance of Various Aspects of Data Processing Knowledge Desired of the Beginning Programmer and the Curricular Implications of the Study." In Moseng's study, "the questionnaire asked respondents to rate sixty topics of data processing knowledge on a four point scale. The respondents were asked to rate the importance of each topic for a beginning programmer on his

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[4]Sidney D. Borcher and John W. Joyner, "Business Data Processing Occupational Performance Survey, Interim Report," Ohio State University, March, 1973.

[5]Ibid.

staff."[6] He found the following topics were rated highest by the respondents: "Debugging Procedures, Disk Organization, Program Documentation Methods, Flow Charting, System Documentation, File Access Methods, Definition of the Problem."[7]

Because of the many changes that have occurred during the past five years in data processing, the author feels a current list of entry level competencies for computer programmers in Wisconsin is necessary. This will allow the nine technical institutes in Wisconsin which offer a data processing programmer degree to re-evaluate their curriculum to make sure they are meeting the needs of their data processing graduates and the community.

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[6]John L. Moseng, "A Study to Determine the Importance of Various Aspects of Data Processing Knowledge Desired of the Beginning Programmer and the Curricular Implications of this Study," Unpublished Masters Paper, UW-Whitewater, November, 1971.

[7]Ibid.

## CHAPTER III

## PROCEDURES

In order to obtain the information desired for this study, two research methods were needed. First a questionnaire was developed and sent to collect most of the data. Second, a follow-up interview was conducted to supplement and verify the data collected from the questionnaire.

### Selection of Population

The population included in this study consisted of all data processing associate degree programming graduates at the nine Wisconsin vocational, technical and adult schools for the years 1973 through 1975 and their supervisors/employers. The districts and schools included were:

District One-Eau Claire
District Two-La Crosse
District Four-Madison
District Six-Kenosha
District Eight-Waukesha
District Nine-Milwaukee
District Twelve-Appleton
District Thirteen-Green Bay
District Fifteen-Wausau

A list of 508 data processing graduates and their addresses was obtained from the nine districts. Three duplicates were identified and eliminated.

### Preparation of Questionnaire

The questionnaire was developed in two stages. First a list of data processing tasks was developed using textbooks, other research studies from the review of literature, advisory committee members,

other data processing instructors, course outlines, and the author's past experience. Please refer to original task list developed in Appendix A. The original task list was given to two local advisory committee members and three other data processing instructors for their evaluation and comments. The questionnaire was revised.

To facilitate responses the tasks were grouped into six categories as follows: systems analysis and design, program design, coding, testing and debugging, documentation, and miscellaneous. Each of the tasks was assigned an item number within its group for reference purposes. Gateway (Kenosha) Technical Institute was also conducting a data processing currioulum study. To avoid a duplicate mailing to the same students, a section was added to the questionnaire to collect data for both studies at the same time.

Each respondent was asked to rate a task on a five point Likert Scale relevant to four criteria: frequency, performance, importance, and future need. Each of the five points on the rating scale were defined for the respondent (refer to Appendix E).

The following people served in an advisory capacity during the development of this questionnaire:

| | |
|---|---|
| Wayne Atkins | - Assistant Director, District One, Eau Claire |
| Roland Krogstad | - State Vocational Education Consultant-Research |
| Ron Porath | - Programmer, American National Bank, past graduate, advisory committee member |
| Lloyd Kragenbring | - Data Processing Manager, Gould National Battery, advisory committee member |
| John Moseng | - Data Processing Instructor, District One |
| Paul Almquist | - Data Processing Instructor, District One |
| Milo Swenson | - Chairperson, Data Processing Department, District One |
| Judy Ferber | - Professional Secretary, District One |

The questionnaire was sent to three data processing programmers (graduates from District One Technical Institute) and one data processing employer/supervisor for a pilot test. Each of the four individuals in the pilot test were asked for their reactions and suggestions. The questionnaire was also reviewed by a member of the state staff of vocational, technical and adult education.

The final questionnaire was developed incorporating the suggestions made by the state staff member and the pilot group (refer to Appendix F).

An informational cover letter was developed and reviewed in the same manner as the questionnaire (refer to Appendix E).

The questionnaire and the informational cover letter were completed in early February, 1976.

Administration of Questionnaire

On February 17, 1976, the questionnaires were sent to 505 data processing graduates with an appropriate cover letter signed by the State Director of Vocational, Technical and Adult Education (refer to Appendix B) and a stamped, self-addressed envelope. A pencil was included to aid in completing the questionnaire. Also included in the mailing was a second copy of the questionnaire with an appropriate cover letter signed by the State Director of Vocational, Technical and Adult Education (refer to Appendix D) and a stamped, self-addressed envelope. The graduates were asked in their letters to give this second copy to their data processing employer/supervisor for them to fill out and return. Fifty-four of these questionnaires mailed to the graduates were returned by the post office with no forwarding address. These 54 names were checked in phone books and the vocational district

registrars were contacted for more recent addresses and 32 were remailed. On March 3, 1976, 357 follow-up questionnaires were sent to non-returnees with an appropriate follow-up letter (refer to Appendix C). The cut-off date for return of questionnaires was April 1, 1976. After the cut-off date three supervisor and one graduate return was received and were not included in the study.

When approximately half of the returns were received, a frequency count of responses was made. Next, a guide for use in interviewing graduates and employers was developed. The interviewing was done to supplement and verify the questionnaire findings. During the weeks of March 22-26, March 29-April 2, and April 5-9, 1976, 26 graduates and 21 employers were interviewed (refer to Appendixes G and H for interview guides).

Tabulation of Completed Questionnaires

The returned questionnaires were coded and the data punched into punch cards and verified for accuracy. Each answer for a task was recorded exactly as it was indicated (example: if the 3 was circled, a 3 was recorded). A computer program was used to process the data and calculate the following statistical measures:

| Description | Formula |
|---|---|
| Frequency of Response[1] | Total Number of each Answer for each Task |
| Mean[2] | $M = \frac{\Sigma X}{N}$ |
| Standard Error (SE) of the Mean (M)[2] | $SE_M = \frac{SD}{\sqrt{N}}$ |
| Standard Deviation[2] | $SD = \sqrt{\frac{\Sigma X^2}{N} - \left(\frac{\Sigma X}{N}\right)^2}$ |
| Standard Error (SE) of the Standard Deviation (SD)[2] | $SE_{SD} = \frac{SD}{\sqrt{2N}}$ |

Upon completion of these statistical computations, the rank value and the mean difference of the ranks for graduates and employers were calculated manually.

---

[1]Refer to Appendix M and N

[2]Refer to Appendix O

# CHAPTER IV

# FINDINGS

## Introduction

This chapter presents the findings of the entry level competencies for data processing programmers. The chapter is divided into three parts: returns, questionnaire data, and follow-up interviews.

## Returns

Tables 4.1A through 4.4 show the number of questionnaires that were mailed and returned.

TABLE 4.1A

QUESTIONNAIRE MAILINGS AND RETURNS FOR GRADUATES

| | No. | Percent |
|---|---|---|
| Mailed | 505 | -- |
| Mailed-Delivered | 480 | 100 |
| Responded | 216 | 45 |
| No Response | 264 | 55 |

In view of the fact that some of these graduates have been away from their training institution for as long as three and one-half years, this response rate appears to be satisfactory. Also some of the graduates that were not in data processing may not have returned their questionnaires.

TABLE 4.1B

RESPONSES BY NUMBER OF PROGRAMMERS
EMPLOYED IN INSTALLATION

| No. Prog. | Graduates | | Employers | |
|---|---|---|---|---|
| | No. | % | No. | % |
| 0-5 | 66 | 48 | 38 | 47 |
| 6-25 | 44 | 32 | 30 | 37 |
| >25 | 28 | 20 | 13 | 16 |
| TOTAL | 138 | 100 | 81 | 100 |

Table 4.1B shows that small, medium, and large size data processing installations were well represented in the study.

TABLE 4.1C

EXPERIENCE OF RESPONDENTS
BY NUMBER OF YEARS OF PROGRAMMING

| Yrs. Experience | Graduates | Employers |
|---|---|---|
| 0-1 | 51 | 3 |
| 2-3 | 80 | 6 |
| 4-10 | 7 | 51 |
| > 10 | 0 | 21 |
| TOTAL | 138 | 81 |

This table indicates that most of the graduates had from none to three years experience which is to be expected because they all graduated in the past three years. All of the employers indicated programming experience with most having over four years.

TABLE 4.2

EMPLOYMENT STATUS OF GRADUATE RESPONDENTS

| | No. | Percent |
|---|---|---|
| Total Responded | 216 | 100 |
| Currently Programmers | 138 | 64 |
| D. P. Related - Not Programmers | 30 | 14 |
| Not in Data Processing | 48 | 22 |

As can be seen from this table, nearly two out of three respondents were bona fide programmers. The "Currently Programmers" group constituted the base upon which the findings were tabulated. D. P. Related and Non-D.P. were eliminated from further tabulation.

Each graduate was mailed a copy of the questionnaire which he/she was requested to give to his/her employer. Because of this technique, it is not possible to ascertain the number of potential employer respondents. Employer response was:

TABLE 4.3

EMPLOYER RESPONSES

| | |
|---|---|
| Usable | 81 |
| Unusable | 2* |
| TOTAL | 83 |

Inasmuch as the number of employer respondents (83) represents 50 percent of the total graduate respondents who were working in data processing (168), this response rate for employees is viewed as being

*Employers noted that they lacked programming experience.

very good. In many instances it was indicated that one employer was completing the questionnaire after having been given a copy by two or more of his/her employees.

TABLE 4.4

RESPONDENT RETURNS BY DISTRICTS

| District No. | District | Mailed Graduates | Grad. Respondents Programmer | Grad. Respondents D.P. Related Not Programmers | Grad. Respondents Not In D.P. | Employer Respondents |
|---|---|---|---|---|---|---|
| 1 | Eau Claire | 45 | 15 | 5 | 5 | 9 |
| 2 | La Crosse | 52 | 7 | 3 | 10 | 3 |
| 4 | Madison | 84 | 19 | 0 | 4 | 15 |
| 6 | Kenosha | 74 | 31 | 3 | 6 | 12 |
| 8 | Waukesha | 15 | 0 | 2 | 1 | 4 |
| 9 | Milwaukee | 95 | 21 | 4 | 9 | 12 |
| 12 | Appleton | 49 | 12 | 7 | 6 | 6 |
| 13 | Green Bay | 36 | 19 | 1 | 3 | 11 |
| 15 | Wausau | 55 | 14 | 5 | 4 | 9 |
| | TOTALS | 505 | 138 | 30 | 48 | 81 |

Table 4.4 indicates the number of questionnaires mailed to graduates and returned for graduates and employers by district within Wisconsin.

A few respondents added comments on their returns. A copy of one letter may be found in Appendix Q.

Questionnaire Data

Tables 4.5 through 4.28 depict the following measures for the four columns of the survey (frequency, performance, importance and future need) for each of the 75 tasks listed:

1. GROUP RANK - rank within group
2. ITEM RANK - rank within entire task list
3. MEAN - AVERAGE RESPONSE - computed as indicated in chapter 3
4. STANDARD DEVIATION - computed as indicated in chapter 3

These measures are indicated for both the graduate and employer groups. The mean difference of the ranks for all 75 items between graduates and employers was 4.63 for frequency, 5.68 for performance, 6.32 for importance, and 5.44 for future need. This was not a significant difference and can be referred to in Appendix O. Appendix P lists the graduate and employer ranks for all tasks by description. Each table shows the four measures for a single task grouping.

Tables 4.5 through 4.10 deal with frequency performed.

TABLE 4.5

RANKING OF TASKS PERFORMED IN SYSTEMS ANALYSIS AND DESIGN IN TERMS OF FREQUENCY OF PERFORMANCE FOR ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 1.00 | SYSTEMS ANALYSIS AND DESIGN | | | | | | | | |
| 1.05 | WORK WITH OTHER PROGRAMMERS ON PROBLEM | 01. | 07.0 | 4.13 | 1.07 | 01. | 09.0 | 4.07 | 1.17 |
| 1.01 | USE COMPANY SYSTEM STANDARDS | 02. | 08.0 | 4.10 | 1.26 | 03. | 17.5 | 3.65 | 1.65 |
| 1.04 | WORK WITH SYSTEMS ANALYST ON PROBLEM | 03. | 19.0 | 3.53 | 1.37 | 02. | 10.5 | 3.99 | 1.29 |
| 1.08 | PREPARE A PRINTER SPACING FORM | 04. | 34.0 | 3.06 | 1.08 | 04. | 35.0 | 3.04 | 1.26 |
| 1.03 | WORK WITH USERS ON PROBLEM | 05. | 37.0 | 2.98 | 1.36 | 05. | 40.0 | 2.80 | 1.36 |
| 1.10 | PREPARE A DISK RECORD LAYOUT | 06. | 45.0 | 2.59 | 1.20 | 06. | 45.0 | 2.73 | 1.28 |
| 1.07 | PREPARE A CARD RECORD LAYOUT | 07. | 49.0 | 2.49 | 1.08 | 07. | 52.0 | 2.58 | 1.31 |
| 1.02 | WRITE A DETAILED DESCRIPTION OF A PROBLEM. | 08. | 51.0 | 2.40 | 1.27 | 10. | 64.0 | 2.04 | 1.21 |
| 1.06 | PREPARE A SYSTEM FLOWCHART | 09. | 55.0 | 2.30 | 1.12 | 09. | 61.0 | 2.17 | 1.27 |
| 1.09 | PREPARE A TAPE RECORD LAYOUT | 10. | 57.5 | 2.27 | 1.17 | 08. | 58.0 | 2.28 | 1.23 |
| 1.11 | PREPARE A PAPER TAPE RECORD LAYOUT | 11. | 75.0 | 1.12 | 0.43 | 11. | 75.0 | 1.33 | 0.82 |

*Mean: 1 = Never 2 = < Monthly 3 = Monthly 4 = Weekly 5 = Daily (See Appendix E)

Table 4.5 indicates that among the eleven tasks within the systems analysis and design group, working with other programmers on a problem was the one most frequently performed in the opinion of both graduates and employers. This task also ranked very high in the entire task list (75 items), with graduates ranking it 7th and employers ranking it 9th. Using company system standards and working with systems analyst on problems were also rated as being frequently performed by both graduates and employers. Preparing a paper tape record layout was almost never performed by either graduates or employers. Both rated it lowest in the system analysis and design group and also lowest in the entire task list (75 items).

TABLE 4.6

RANKING OF TASKS PERFORMED IN PROGRAM DESIGN IN TERMS OF FREQUENCY OF PERFORMANCE FOR ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 2.00 | PROGRAM DESIGN | | | | | | | | |
| 2.09 | SELECT APPROPRIATE DATA NAMES FOR DATA | 01. | 09.0 | 4.05 | 1.11 | 02. | 22.0 | 3.49 | 1.52 |
| 2.08 | PREPARE A TEST DATA FOR PROGRAMS | 02. | 18.0 | 3.55 | 1.11 | 01. | 13.5 | 3.81 | 1.03 |
| 2.01 | USE STANDARD FLOWCHART SYMBOLS | 03. | 25.0 | 3.26 | 1.22 | 03. | 23.5 | 3.44 | 1.39 |
| 2.07 | USE STRUCTURED PROGRAMMING TECHNIQUES | 04. | 26.0 | 3.22 | 1.51 | 05. | 38.5 | 2.81 | 1.69 |
| 2.02 | PREPARE A GENERAL (LOGIC) PROGRAM FLOWCHART | 05. | 35.5 | 3.01 | 1.10 | 04. | 33.0 | 3.11 | 1.27 |
| 2.10 | SELECT FILE ORGANIZATION & ACCESS METHODS FOR DATA FILES | 06. | 47.0 | 2.55 | 1.34 | 08. | 56.0 | 2.40 | 1.40 |
| 2.03 | PREPARE A DETAIL PROGRAM FLOWCHART | 07. | 50.0 | 2.47 | 1.20 | 06. | 46.0 | 2.68 | 1.36 |
| 2.06 | DIVIDE A PROGRAM INTO MODULES | 08. | 59.5 | 2.26 | 1.17 | 07. | 54.0 | 2.53 | 1.37 |
| 2.11 | SELECT APPROPRIATE PROGRAMMING LANGUAGE FOR PROBLEM | 09. | 68.0 | 1.78 | 1.28 | 10. | 69.0 | 1.65 | 1.19 |
| 2.05 | PREPARE A DECISION TABLE | 10. | 73.0 | 1.52 | 0.83 | 09. | 67.0 | 1.79 | 1.01 |
| 2.04 | PREPARE A GRID CHART | 11. | 74.0 | 1.23 | 0.55 | 11. | 72.0 | 1.51 | 0.83 |

*Mean: 1 = Never 2 = < Monthly 3 = Monthly 4 = Weekly 5 = Daily (See Appendix E)

In Table 4.6 the graduates chose selecting appropriate data names for data as the most frequently performed task in the program design group. Employers ranked this task number two in the group. The graduates also ranked it very high in the entire task list with a rank of 9 of 75. Use company system standards was rated most frequently performed by entry level programmers for this group and the graduates rated it second. Three tasks, select appropriate programming language for problem, prepare a decision table, and prepare a grid chart were rated lowest in the group by both graduates and employers. They were also rated very low in the entire item list by both, ranking 68, 73, and 74th by graduates and 69, 67, and 72nd by employers respectively.

TABLE 4.7

RANKING OF TASKS PERFORMED IN CODING IN TERMS OF FREQUENCY OF PERFORMANCE FOR ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 3.00 | CODING | | | | | | | | |
| 3.26 | USE CODING SHEETS | 01. | 03.5 | 4.52 | 1.01 | 01. | 03.0 | 4.74 | 0.70 |
| 3.20 | WRITE COMMENTS IN PROGRAM | 02. | 12.0 | 3.94 | 1.20 | 02. | 08.0 | 4.16 | 1.08 |
| 3.02 | WRITE HIGHER LEVEL LANGUAGE INSTRUCTIONS | 03. | 13.0 | 3.86 | 1.53 | 03. | 12.0 | 3.91 | 1.62 |
| 3.16 | WRITE ERROR ROUTINES | 04. | 17.0 | 3.64 | 1.18 | 07. | 21.0 | 3.51 | 1.21 |
| 3.09 | WRITE SEQUENTIAL DISK FILE HANDLING ROUTINES | 05. | 20.0 | 3.50 | 1.26 | 08. | 25.0 | 3.41 | 1.37 |
| 3.22 | WRITE EDIT ROUTINES | 06. | 21.5 | 3.42 | 1.13 | 05. | 17.5 | 3.65 | 1.08 |
| 3.05 | USE DISK SORT UTILITY ROUTINES | 07. | 23.0 | 3.34 | 1.29 | 04. | 16.0 | 3.73 | 1.20 |
| 3.13 | USE CARD FILE HANDLING ROUTINES | 08. | 24.0 | 3.33 | 1.29 | 09. | 27.0 | 3.32 | 1.43 |
| 3.17 | USE LIBRARY ROUTINES | 09. | 27.0 | 3.19 | 1.47 | 06. | 20.0 | 3.54 | 1.38 |
| 3.07 | WRITE TABLE SEARCHING INSTRUCTIONS | 10. | 28.0 | 3.17 | 1.15 | 11. | 31.0 | 3.21 | 1.25 |
| 3.12 | USE TAPE FILE HANDLING ROUTINES | 11. | 29.0 | 3.16 | 1.48 | 12. | 32.0 | 3.20 | 1.41 |
| 3.06 | WRITE TABLE BUILDING INSTRUCTIONS | 12. | 30.0 | 3.13 | 1.18 | 13. | 34.0 | 3.07 | 1.28 |
| 3.10 | USE INDEX-SEQUENTIAL DISK FILE HANDLING ROUTINES | 13. | 33.0 | 3.07 | 1.32 | 10. | 29.0 | 3.29 | 1.39 |
| 3.15 | WRITE SUBROUTINES | 14. | 40.0 | 2.91 | 1.42 | 14. | 36.0 | 2.98 | 1.36 |
| 3.21 | WRITE INSTRUCTIONS FOR INTERNAL/EXTERNAL CONTROLS | 15. | 42.0 | 2.76 | 1.42 | 15. | 37.0 | 2.87 | 1.42 |
| 3.11 | USE RANDOM DISK FILE HANDLING ROUTINES | 16. | 43.0 | 2.63 | 1.34 | 16. | 48.0 | 2.65 | 1.34 |
| 3.19 | USE MACROS | 17. | 52.0 | 2.37 | 1.49 | 18. | 55.0 | 2.41 | 1.50 |
| 3.14 | USE DATA COMMUNICATIONS ROUTINES | 18. | 56.0 | 2.28 | 1.42 | 21. | 63.0 | 2.11 | 1.34 |
| 3.04 | USE TAPE SORT UTILITY ROUTINES | 19. | 59.5 | 2.26 | 1.38 | 17. | 53.0 | 2.56 | 1.48 |
| 3.03 | WRITE REPORT PROGRAM GENERATOR LANGUAGE INSTRUCTIONS | 20. | 63.0 | 2.06 | 1.58 | 19.5 | 61.0 | 2.17 | 1.49 |
| 3.08 | WRITE TABLE SORTING INSTRUCTIONS | 21. | 64.0 | 1.99 | 1.13 | 19.5 | 61.0 | 2.17 | 1.23 |
| 3.01 | WRITE ASSEMBLER LANGUAGE INSTRUCTIONS | 22. | 65.0 | 1.95 | 1.43 | 22. | 65.0 | 1.98 | 1.41 |
| 3.23 | WRITE CHECK DIGIT CHECKING ROUTINES | 23. | 66.0 | 1.88 | 1.09 | 24. | 68.0 | 1.73 | 1.08 |
| 3.18 | WRITE LIBRARY ROUTINES | 24. | 67.0 | 1.83 | 1.14 | 23. | 66.0 | 1.95 | 1.23 |
| 3.24 | WRITE CHECK POINT-RESTART INSTRUCTIONS | 25. | 69.0 | 1.73 | 1.04 | 25. | 70.0 | 1.63 | 0.92 |
| 3.25 | WRITE FORM TEST PATTERN ROUTINES | 26. | 70.0 | 1.70 | 1.05 | 26. | 73.0 | 1.50 | 0.84 |

*Mean: 1 = Never 2 = < Monthly 3 = Monthly 4 = Weekly 5 = Daily (See Appendix E)

Table 4.7 depicts three tasks, use coding sheets, write comments in program, and write higher level language instructions ranking 1, 2, and 3 by both graduates and employers for frequency performed. These three tasks also ranked very high in the entire list. Use coding sheets held an item rank of 3, according to employers and 3.5 by graduates. Write comments in program had an item rank of 8 for employers and 12 for graduates. Write higher level language instructions ranked 12th for employers and 13th for graduates in the entire list (75 items). Write form test pattern routines ranked last in the group for both graduates and employers. For item rank the employers listed it 73rd and the graduates, 70th, indicating that it is not done very often. Write check point-restart instructions was listed second to last in the group by both groups answering questionnaires. It was also very low in item rank, rating 70th by employers and 69 by graduates.

TABLE 4.8

RANKING OF TASKS PERFORMED IN TESTING AND DEBUGGING IN TERMS OF FREQUENCY OF PERFORMANCE FOR ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 4.00 | TESTING AND DEBUGGING | | | | | | | | |
| 4.01 | READ A PROGRAM LISTING | 01. | 01.0 | 4.85 | 0.50 | 01. | 01.0 | 4.93 | 0.31 |
| 4.02 | DESK CHECK A PROGRAM | 02. | 02.0 | 4.54 | 0.74 | 02. | 02.0 | 4.81 | 0.39 |
| 4.03 | CORRECT SYNTAX (CLERICAL) ERRORS | 03. | 03.5 | 4.52 | 0.79 | 03. | 04.0 | 4.67 | 0.67 |
| 4.04 | CORRECT LOGICAL ERRORS | 04. | 06.0 | 4.45 | 0.78 | 04. | 05.0 | 4.62 | 0.64 |
| 4.09 | TEST PROGRAM USING TEST DATA | 05. | 10.0 | 4.04 | 0.92 | 05. | 06.0 | 4.42 | 0.72 |
| 4.07 | READ A FILE DUMP | 06.5 | 14.5 | 3.68 | 1.12 | 06. | 13.5 | 3.81 | 1.12 |
| 4.08 | READ A CROSS-REFERENCE LISTING | 06.5 | 14.5 | 3.68 | 1.35 | 08. | 19.0 | 3.64 | 1.44 |
| 4.10 | TEST PROGRAM USING LIVE (USER) DATA | 08. | 16.0 | 3.65 | 1.07 | 07. | 15.0 | 3.74 | 1.12 |
| 4.06 | READ A MEMORY DUMP | 09. | 32.0 | 3.08 | 1.29 | 10. | 30.0 | 3.27 | 1.41 |
| 4.12 | RECOMMEND CORRECTIONS OR MODIFICATIONS TO PROGRAMS | 10. | 39.0 | 2.93 | 1.22 | 09. | 28.0 | 3.30 | 1.23 |
| 4.05 | READ A TRACE | 11. | 57.5 | 2.27 | 1.19 | 11. | 44.0 | 2.74 | 1.31 |
| 4.11 | EDIT PROGRAM FOR EFFECTIVE USE OF AUXILIARY STORAGE | 12. | 62.0 | 2.20 | 1.30 | 12. | 59.0 | 2.25 | 1.25 |

*Mean: 1 = Never 2 = < Monthly 3 = Monthly 4 = Weekly 5 = Daily (See Appendix E)

Table 4.8 indicates that among the twelve tasks within the testing and debugging group, five tasks were performed almost daily in the opinion of both graduates and employers, all having a mean (average) of above 4.0 out of five. These five tasks starting with the most frequently performed were: reading a program listing, desk checking a program, correcting syntax errors, correcting logical errors, and test program using test data. All five tasks also ranked very high in the entire task list with graduates and employers ranking reading a program listing as 1st. Graduates and employers ranked desk checking a program as 2nd. Correcting syntax errors was ranked 3.5 by graduates and 4th by employers in the entire list. Employers ranked correcting logical errors as 5th and graduates, 6th. Testing program using test data was ranked 6th by employers and 10th by graduates. Reading a trace and editing program for effective use of auxiliary storage were rated second to last and last respectively by both graduates and employers.

TABLE 4.9

RANKING OF TASKS PERFORMED IN DOCUMENTATION IN TERMS OF FREQUENCY OF PERFORMANCE FOR ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 5.00 | DOCUMENTATION | | | | | | | | |
| 5.02 | WRITE COMPUTER OPERATOR INSTRUCTIONS | 01. | 31.0 | 3.11 | 1.22 | 01. | 23.5 | 3.44 | 1.23 |
| 5.03 | WRITE DOCUMENTATION UPDATES AFTER A PROGRAM REVISION | 02. | 38.0 | 2.96 | 1.19 | 02. | 26.0 | 3.35 | 1.22 |
| 5.01 | PREPARE A PROGRAM DOCUMENTATION MANUAL | 03. | 48.0 | 2.51 | 1.27 | 03. | 41.0 | 2.78 | 1.34 |
| 5.04 | SUMMARIZE THE CONTROLS IN PROGRAM TO DETECT ERRORS | 04. | 53.5 | 2.34 | 1.30 | 04. | 42.5 | 2.77 | 1.24 |
| 5.05 | SUMMARIZE CALCULATIONS USED IN PROGRAM | 05. | 61.0 | 2.25 | 1.22 | 05. | 49.0 | 2.64 | 1.32 |

*Mean: 1 = Never 2 = < Monthly 3 = Monthly 4 = Weekly 5 = Daily (See Appendix E)

Table 4.9 shows the task write computer operator instructions was indicated as being performed most frequently by both graduates and employers in the documentation group. Summarize calculations used in program was rated lowest in the group by both graduates and employers.

TABLE 4.10

RANKING OF MISCELLANEOUS TASKS PERFORMED IN TERMS OF FREQUENCY OF PERFORMANCE FOR ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 6.00 | MISCELLANEOUS | | | | | | | | |
| 6.06 | USE JOB CONTROL LANGUAGE (CONTROL CARDS) | 01. | 05.0 | 4.49 | 1.15 | 01. | 07.0 | 4.37 | 1.24 |
| 6.03 | PERFORM PROGRAM MAINTENANCE | 02. | 11.0 | 3.96 | 1.07 | 02. | 10.5 | 3.99 | 1.01 |
| 6.02 | PATCH COMPUTER PROGRAMS | 03. | 21.5 | 3.42 | 1.48 | 06. | 50.0 | 2.61 | 1.57 |
| 6.05 | OPERATE COMPUTER FOR PROGRAM TESTS | 04. | 35.5 | 3.01 | 1.62 | 04. | 42.5 | 2.77 | 1.66 |
| 6.08 | PERFORM NUMBER SYSTEM ARITHMETIC | 05. | 41.0 | 2.81 | 1.58 | 03. | 38.5 | 2.81 | 1.60 |
| 6.01 | KEYPUNCH PROGRAM | 06. | 44.0 | 2.61 | 1.31 | 05. | 47.0 | 2.67 | 1.32 |
| 6.09 | CONVERT NUMBERS BETWEEN NUMBER SYSTEMS | 07. | 46.0 | 2.56 | 1.47 | 07. | 51.0 | 2.59 | 1.55 |
| 6.07 | USE VIRTUAL STORAGE TECHNIQUES | 08. | 53.5 | 2.34 | 1.63 | 08. | 57.0 | 2.39 | 1.57 |
| 6.04 | CONVERT A PROGRAM TO ANOTHER LANGUAGE | 09. | 71.0 | 1.56 | 0.83 | 10. | 74.0 | 1.46 | 0.79 |
| 6.10 | PREPARE PRINTER CARRIAGE TAPE | 10. | 72.0 | 1.53 | 0.66 | 09. | 71.0 | 1.59 | 0.77 |

*Mean: 1 = Never 2 = <Monthly 3 = Monthly 4 = Weekly 5 = Daily (See Appendix E)

Table 4.10 both the graduates and employers selected use job control languages as the most frequently performed task in the miscellaneous group. This task was also rated very high in the entire task list with the graduate rating it 5th and the employers, 7th. Both also chose perform program maintenance as the second most frequently performed task in the group. The least frequently performed task according to the graduates was prepare a printer carriage tape. Employers rated it 9th in the group of 10. The employers rated convert a program to another language as being the lowest in the group and the graduates rated this one 9th in the group of 10. These two tasks were also rated very low in the total list of 75 items. The graduates rated prepare a printer carriage tape 72nd and employers, 71st. Convert a program to another language was rated 74th by employers and 71st by graduates.

Tables 4.11 through 4.16 deal with the performance level or proficiency needed by entry level programmers over a range from leading others in performing the tasks to merely assisting others.

TABLE 4.11

RANKING OF TASKS PERFORMED IN SYSTEMS ANALYSIS AND DESIGN IN TERMS OF PROFICIENCY NEEDED BY ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 1.00 | SYSTEMS ANALYSIS AND DESIGN | | | | | | | | |
| 1.05 | WORK WITH OTHER PROGRAMMERS ON PROBLEM | 01.5 | 19.5 | 3.71 | 0.81 | 01. | 09.0 | 3.43 | 0.75 |
| 1.08 | PREPARE A PRINTER SPACING FORM | 01.5 | 19.5 | 3.71 | 0.86 | 02. | 19.5 | 3.36 | 0.83 |
| 1.10 | PREPARE A DISK RECORD LAYOUT | 03. | 26.0 | 3.64 | 0.97 | 04. | 31.0 | 3.22 | 0.83 |
| 1.07 | PREPARE A CARD RECORD LAYOUT | 04. | 31.0 | 3.57 | 0.98 | 03. | 21.0 | 3.33 | 0.89 |
| 1.09 | PREPARE A TAPE RECORD LAYOUT | 05. | 37.0 | 3.49 | 0.96 | 05. | 33.0 | 3.21 | 0.83 |
| 1.04 | WORK WITH SYSTEMS ANALYST ON PROBLEM | 06. | 44.5 | 3.37 | 0.89 | 06. | 40.5 | 3.11 | 0.98 |
| 1.01 | USE COMPANY SYSTEM STANDARDS | 07. | 46.0 | 3.34 | 0.80 | 08. | 51.0 | 2.97 | 0.85 |
| 1.03 | WORK WITH USERS ON PROBLEM | 08. | 52.0 | 3.26 | 0.92 | 09. | 63.0 | 2.75 | 0.98 |
| 1.06 | PREPARE A SYSTEM FLOWCHART | 09. | 57.5 | 3.21 | 1.06 | 07. | 47.0 | 3.00 | 0.88 |
| 1.02 | WRITE A DETAILED DESCRIPTION OF A PROBLEM. | 10. | 69.0 | 2.96 | 0.88 | 10. | 66.0 | 2.64 | 0.78 |
| 1.11 | PREPARE A PAPER TAPE RECORD LAYOUT | 11. | 75.0 | 2.05 | 1.21 | 11. | 75.0 | 2.28 | 1.15 |

*Mean: 1 = Very Low 2 = Low 3 = Average 4 = High 5 = Very High (See Appendix E)

Table 4.11 indicates that among the twelve tasks within the systems analysis group, working with other programmers on program and preparing a printer spacing form needed the highest performance in the opinion of the graduates. The employers rated these two tasks as 1st and 2nd also. Preparing a paper tape record layout was rated last by both graduates and employers in the group and the entire list of all items.

TABLE 4.12

RANKING OF TASKS PERFORMED IN PROGRAM DESIGN IN TERMS OF PROFICIENCY NEEDED BY ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 2.00 | PROGRAM DESIGN | | | | | | | | |
| 2.09 | SELECT APPROPRIATE DATA NAMES FOR DATA | 01. | 10.0 | 3.85 | 0.80 | 03. | 27.0 | 3.26 | 0.96 |
| 2.08 | PREPARE A TEST DATA FOR PROGRAMS | 02. | 21.5 | 3.70 | 0.84 | 01. | 16.0 | 3.39 | 0.84 |
| 2.01 | USE STANDARD FLOWCHART SYMBOLS | 03.5 | 24.0 | 3.66 | 0.88 | 02. | 23.0 | 3.32 | 0.84 |
| 2.02 | PREPARE A GENERAL (LOGIC) PROGRAM FLOWCHART | 03.5 | 24.0 | 3.66 | 0.87 | 04. | 34.5 | 3.17 | 0.81 |
| 2.03 | PREPARE A DETAIL PROGRAM FLOWCHART | 05. | 31.0 | 3.57 | 0.90 | 05. | 42.0 | 3.08 | 0.76 |
| 2.07 | USE STRUCTURED PROGRAMMING TECHNIQUES | 06. | 35.0 | 3.51 | 0.94 | 06. | 44.0 | 3.06 | 1.00 |
| 2.11 | SELECT APPROPRIATE PROGRAMMING LANGUAGE FOR PROBLEM | 07. | 48.0 | 3.32 | 1.23 | 09. | 60.0 | 2.84 | 1.25 |
| 2.10 | SELECT FILE ORGANIZATION AND ACCESS METHODS FOR DATA FILES | 08. | 57.5 | 3.21 | 0.99 | 08. | 55.0 | 2.93 | 1.14 |
| 2.06 | DIVIDE A PROGRAM INTO MODULES | 09. | 59.0 | 3.19 | 0.90 | 07. | 49.5 | 2.98 | 0.96 |
| 2.05 | PREPARE A DECISION TABLE | 10. | 71.0 | 2.81 | 0.98 | 10. | 69.0 | 2.59 | 0.83 |
| 2.04 | PREPARE A GRID CHART | 11. | 74.0 | 2.33 | 0.97 | 11. | 71.0 | 2.55 | 0.86 |

*Mean: 1 = Very Low 2 = Low 3 = Average 4 = High 5 = Very High (See Appendix E)

Table 4.12 indicates graduates felt selecting appropriate data names for data needed the highest level of performance in the program design group. Employers ranked it as number 3 in the group. Prepare test data for programs was rated 1st by employers and 2nd by graduates. Prepare a grid chart was rated as needing the lowest performance by both graduates and employers. It also ranked very low in the item list, 74th by graduates, and 71st by employers of 75 items total. Prepare a decision table was rated 2nd to last in the group by both graduates and employers. It also ranked 71st for graduates and 69 for employers in the entire item list.

TABLE 4.13

RANKING OF TASKS PERFORMED IN CODING IN TERMS OF PROFICIENCY NEEDED BY ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 3.00 | CODING | | | | | | | | |
| 3.26 | USE CODING SHEETS | 01. | 01.0 | 4.21 | 0.83 | 01. | 01.0 | 4.00 | 0.79 |
| 3.20 | WRITE COMMENTS IN PROGRAM | 02. | 06.0 | 3.92 | 0.91 | 04. | 12.0 | 3.42 | 0.93 |
| 3.16 | WRITE ERROR ROUTINES | 03. | 11.0 | 3.78 | 0.80 | 11.5 | 27.0 | 3.26 | 0.71 |
| 3.03 | WRITE REPORT PROGRAM GENERATOR LANGUAGE INSTRUCTIONS | 04. | 66.0 | 3.77 | 0.94 | 17.5 | 53.0 | 2.94 | 1.06 |
| 3.13 | USE CARD FILE HANDLING ROUTINES | 06. | 14.0 | 3.76 | 0.87 | 07. | 18.0 | 3.37 | 0.74 |
| 3.10 | USE INDEX-SEQUENTIAL DISK FILE HANDLING ROUTINES | 06. | 34.0 | 3.76 | 0.80 | 11.5 | 27.0 | 3.26 | 0.92 |
| 3.06 | WRITE TABLE BUILDING INSTRUCTIONS | 06. | 29.0 | 3.76 | 0.86 | 13. | 31.0 | 3.22 | 0.75 |
| 3.22 | WRITE EDIT ROUTINES | 08. | 21.5 | 3.70 | 0.86 | 08. | 19.5 | 3.36 | 0.73 |
| 3.17 | USE LIBRARY ROUTINES | 09.5 | 27.5 | 3.61 | 0.94 | 09. | 23.0 | 3.32 | 0.81 |
| 3.08 | WRITE TABLE SORTING INSTRUCTIONS | 09.5 | 61.5 | 3.61 | 0.85 | 19. | 56.0 | 2.91 | 0.85 |
| 3.07 | WRITE TABLE SEARCHING INSTRUCTIONS | 11. | 27.5 | 3.60 | 0.85 | 10. | 25.0 | 3.27 | 0.75 |
| 3.15 | WRITE SUBROUTINES | 12. | 33.0 | 3.55 | 0.98 | 15. | 40.5 | 3.11 | 0.86 |
| 3.11 | USE RANDOM DISK FILE HANDLING ROUTINES | 13. | 44.5 | 3.54 | 0.89 | 16. | 47.0 | 3.00 | 0.95 |
| 3.21 | WRITE INSTRUCTIONS FOR INTERNAL/EXTERNAL CONTROLS | 14. | 41.0 | 3.44 | 0.92 | 20. | 60.0 | 2.84 | 0.96 |
| 3.05 | USE DISK SORT UTILITY ROUTINES | 15. | 14.0 | 3.41 | 1.01 | 05.5 | 16.0 | 3.39 | 0.83 |
| 3.12 | USE TAPE FILE HANDLING ROUTINES | 16. | 24.0 | 3.37 | 0.94 | 03. | 09.0 | 3.43 | 0.80 |
| 3.14 | USE DATA COMMUNICATIONS ROUTINES | 17. | 55.0 | 3.23 | 1.06 | 25. | 72.5 | 2.53 | 1.01 |
| 3.19 | USE MACROS | 18. | 60.0 | 3.18 | 1.16 | 17.5 | 53.0 | 2.94 | 1.00 |
| 3.09 | WRITE SEQUENTIAL DISK FILE HANDLING ROUTINES | 19. | 14.0 | 3.17 | 0.99 | 02. | 09.0 | 3.43 | 0.79 |
| 3.23 | WRITE CHECK DIGIT CHECKING ROUTINES | 20. | 63.5 | 3.16 | 1.08 | 23. | 68.0 | 2.60 | 0.79 |
| 3.02 | WRITE HIGHER LEVEL LANGUAGE INSTRUCTIONS | 21. | 12.0 | 3.13 | 1.17 | 05.5 | 16.0 | 3.39 | 0.92 |
| 3.04 | USE TAPE SORT UTILITY ROUTINES | 22. | 42.0 | 3.12 | 1.16 | 14. | 38.0 | 3.13 | 0.89 |
| 3.18 | WRITE LIBRARY ROUTINES | 23. | 67.0 | 3.07 | 1.00 | 22. | 65.0 | 2.67 | 1.14 |
| 3.01 | WRITE ASSEMBLER LANGUAGE INSTRUCTIONS | 24. | 65.0 | 3.00 | 0.82 | 21. | 64.0 | 2.71 | 1.13 |
| 3.25 | WRITE FORM TEST PATTERN ROUTINES | 25. | 68.0 | 2.98 | 0.99 | 24. | 70.0 | 2.57 | 1.05 |
| 3.24 | WRITE CHECK POINT-RESTART INSTRUCTIONS | 26. | 70.0 | 2.94 | 1.17 | 26. | 74.0 | 2.43 | 0.95 |

*Mean: 1 = Very Low 2 = Low 3 = Average 4 = High 5 = Very High (See Appendix E)

Table 4.13 indicates that of the twenty-six items in the coding group, both graduates and employers felt the entry level programmers needed a very high performance level with the use coding sheets task. It was also ranked highest in entire item list by both graduates and employers. Write check point-restart instructions was ranked last in the coding group by both graduates and employers. It also ranked very low in the entire item list of 75 with the employers placing it 74th and the graduates, 70th.

TABLE 4.14

RANKING OF TASKS PERFORMED IN TESTING AND DEBUGGING IN TERMS OF PROFICIENCY NEEDED BY ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 4.00 | TESTING AND DEBUGGING | | | | | | | | |
| 4.01 | READ A PROGRAM LISTING | 01. | 02.0 | 4.20 | 0.73 | 01. | 02.0 | 3.83 | 0.80 |
| 4.03 | CORRECT SYNTAX (CLERICAL) ERRORS | 02. | 03.0 | 4.16 | 0.75 | 02. | 03.0 | 3.81 | 0.74 |
| 4.04 | CORRECT LOGICAL ERRORS | 03. | 04.0 | 4.01 | 0.75 | 05. | 06.5 | 3.53 | 0.88 |
| 4.02 | DESK CHECK A PROGRAM | 04. | 05.0 | 3.98 | 0.84 | 04. | 05.0 | 3.63 | 0.99 |
| 4.09 | TEST PROGRAM USING TEST DATA | 05.5 | 08.5 | 3.89 | 0.75 | 03. | 04.0 | 3.64 | 0.84 |
| 4.08 | READ A CROSS-REFERENCE LISTING | 05.5 | 08.5 | 3.89 | 0.96 | 06.5 | 12.0 | 3.42 | 0.88 |
| 4.10 | TEST PROGRAM USING LIVE (USER) DATA. | 07. | 16.0 | 3.74 | 0.81 | 06.5 | 12.0 | 3.42 | 0.96 |
| 4.07 | READ A FILE DUMP | 08. | 17.5 | 3.72 | 0.99 | 08. | 23.0 | 3.32 | 0.83 |
| 4.06 | READ A MEMORY DUMP | 09. | 47.0 | 3.33 | 1.08 | 11. | 58.0 | 2.87 | 0.96 |
| 4.12 | RECOMMEND CORRECTIONS OR MODIFICATIONS TO PROGRAMS | 10. | 50.5 | 3.29 | 0.91 | 09. | 45.0 | 3.03 | 0.94 |
| 4.05 | READ A TRACE | 11. | 53.0 | 3.24 | 0.97 | 10. | 57.0 | 2.89 | 0.91 |
| 4.11 | EDIT PROGRAM FOR EFFECTIVE USE OF AUXILIARY STORAGE. | 12. | 61.5 | 3.17 | 0.98 | 12. | 62.0 | 2.76 | 1.01 |

*Mean: 1 = Very Low 2 = Low 3 = Average 4 = High 5 = Very High (See Appendix E)

Table 4.14 indicates that in the opinion of both graduates and employers several tasks in the testing and debugging group needed a high performance level. Reading a program listing was ranked 1st in the group by both graduates and employers. In the entire item list both graduates and employers ranked it number 2. Correcting syntax errors was ranked 2nd in the group and 3rd in the entire list by both graduates and employers. The task ranked 3rd by graduates and 5th by employers was correct logical errors. In the entire list graduates ranked it 5th and employers, 6.5. Desk checking a program was ranked 4th in the testing and debugging group and 5th in the entire list of 75 items by both graduates and employers. The task which both group ranked last in this group was edit program for effective use of auxiliary storage.

TABLE 4.15

RANKING OF TASKS PERFORMED IN DOCUMENTATION IN TERMS OF PROFICIENCY NEEDED BY ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 5.00 | DOCUMENTATION | | | | | | | | |
| 5.02 | WRITE COMPUTER OPERATOR INSTRUCTIONS . . . . . | 01. | 31.0 | 3.57 | 0.88 | 01. | 39.0 | 3.12 | 0.97 |
| 5.03 | WRITE DOCUMENTATION UPDATES AFTER A PROGRAM REVISION . . . . . | 02. | 38.0 | 3.47 | 0.86 | 02. | 43.0 | 3.07 | 0.96 |
| 5.01 | PREPARE A PROGRAM DOCUMENTATION MANUAL . . . . . | 03. | 50.5 | 3.29 | 0.97 | 03. | 47.0 | 3.00 | 0.98 |
| 5.04 | SUMMARIZE THE CONTROLS IN PROGRAM TO DETECT ERRORS . . . . . | 04.5 | 55.0 | 3.23 | 0.89 | 04. | 49.5 | 2.98 | 0.90 |
| 5.05 | SUMMARIZE CALCULATIONS USED IN PROGRAM . . . . . | 04.5 | 55.0 | 3.23 | 0.90 | 05. | 53.0 | 2.94 | 0.80 |

*Mean: 1 = Very Low 2 = Low 3 = Average 4 = High 5 = Very High (See Appendix E)

In Table 4.15 both the graduates and employers felt the highest performance was needed for the write computer operator instructions task, in the documentation group. Employers rated the task summarize calculations used in program as needing the lowest performance by entry level programmers. The graduates ranked it 4.5 out of 5 equal with summarize the controls in program to detect errors.

TABLE 4.16

RANKING OF MISCELLANEOUS TASKS PERFORMED IN TERMS OF PROFICIENCY NEEDED BY ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 6.00 | MISCELLANEOUS | | | | | | | | |
| 6.06 | USE JOB CONTROL LANGUAGE (CONTROL CARDS) | 01. | 07.0 | 3.90 | 0.97 | 01. | 06.5 | 3.53 | 0.99 |
| 6.03 | PERFORM PROGRAM MAINTENANCE | 02. | 17.5 | 3.72 | 0.83 | 02. | 14.0 | 3.41 | 0.77 |
| 6.02 | PATCH COMPUTER PROGRAMS | 03. | 36.0 | 3.50 | 1.07 | 04. | 31.0 | 3.22 | 1.00 |
| 6.05 | OPERATE COMPUTER FOR PROGRAM TESTS | 04.5 | 39.5 | 3.45 | 1.25 | 05. | 34.5 | 3.17 | 1.25 |
| 6.08 | PERFORM NUMBER SYSTEM ARITHMETIC | 04.5 | 39.5 | 3.45 | 1.00 | 06.5 | 36.5 | 3.14 | 0.96 |
| 6.09 | CONVERT NUMBERS BETWEEN NUMBER SYSTEMS | 06. | 43.0 | 3.39 | 1.01 | 06.5 | 36.5 | 3.14 | 1.04 |
| 6.01 | KEYPUNCH PROGRAM | 07. | 49.0 | 3.31 | 1.14 | 03. | 29.0 | 3.25 | 1.03 |
| 6.07 | USE VIRTUAL STORAGE TECHNIQUES | 08. | 63.5 | 3.16 | 1.20 | 08. | 60.0 | 2.84 | 1.07 |
| 6.04 | CONVERT A PROGRAM TO ANOTHER LANGUAGE | 09. | 72.0 | 2.75 | 1.07 | 09. | 67.0 | 2.61 | 1.06 |
| 6.10 | PREPARE PRINTER CARRIAGE TAPE | 10. | 73.0 | 2.74 | 1.20 | 10. | 72.5 | 2.53 | 0.99 |

*Mean: 1 = Very Low 2 = Low 3 = Average 4 = High 5 = Very High (See Appendix E)

Table 4.16 indicates within the ten tasks in the miscellaneous group, use job control language needed the highest performance in the opinion of both graduates and employers. This task also ranked very high in the entire list (75 items), with employers ranking it 6.5 and graduates ranking it 7th. The two tasks rated lowest in performance for miscellaneous group were prepare printer carriage tape rating 10th and convert a program to another language rating 9th by both graduates and employers. These two tasks also rated very low on the performance scale for the entire list of task items. Prepare a printer carriage tape was ranked 73rd by graduates and 72.5 by employers, and convert a program to another language was ranked 72nd by graduates and 67 by employers.

Tables 4.17 through 4.22 deal with how important the task is for an entry level programmer over a range from being slightly important to being critical for entry level employment.

TABLE 4.17

RANKING OF TASKS PERFORMED IN SYSTEMS ANALYSIS AND DESIGN IN TERMS OF MASTERY OF THE TASK BY ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 1.00 | SYSTEMS ANALYSIS AND DESIGN | | | | | | | | |
| 1.05 | WORK WITH OTHER PROGRAMMERS ON PROBLEM | 01. | 12.0 | 3.78 | 0.86 | 01.5 | 13.5 | 3.68 | 0.91 |
| 1.04 | WORK WITH SYSTEMS ANALYST ON PROBLEM | 02. | 25.0 | 3.62 | 0.98 | 01.5 | 13.5 | 3.68 | 0.98 |
| 1.03 | WORK WITH USERS ON PROBLEM | 03. | 31.0 | 3.50 | 1.07 | 08. | 52.0 | 3.08 | 1.18 |
| 1.10 | PREPARE A DISK RECORD LAYOUT | 04. | 35.0 | 3.46 | 1.03 | 03. | 18.0 | 3.58 | 0.95 |
| 1.08 | PREPARE A PRINTER SPACING FORM | 05. | 40.0 | 3.37 | 0.97 | 05.5 | 36.0 | 3.34 | 0.91 |
| 1.01 | USE COMPANY SYSTEM STANDARDS | 06. | 43.0 | 3.27 | 1.09 | 04. | 27.5 | 3.41 | 1.06 |
| 1.09 | PREPARE A TAPE RECORD LAYOUT | 07. | 46.5 | 3.18 | 1.04 | 05.5 | 36.0 | 3.34 | 1.06 |
| 1.07 | PREPARE A CARD RECORD LAYOUT | 08. | 55.0 | 3.11 | 1.06 | 07. | 49.5 | 3.11 | 1.20 |
| 1.02 | WRITE A DETAILED DESCRIPTION OF A PROBLEM | 09. | 62.0 | 2.99 | 1.12 | 09.5 | 56.0 | 3.04 | 0.97 |
| 1.06 | PREPARE A SYSTEM FLOWCHART | 10. | 63.0 | 2.94 | 1.05 | 09.5 | 56.0 | 3.04 | 1.08 |
| 1.11 | PREPARE A PAPER TAPE RECORD LAYOUT | 11. | 75.0 | 1.73 | 1.05 | 11. | 75.0 | 1.96 | 1.14 |

*Mean: 1 = Slight 2 = Some 3 = Important 4 = Very 5 = Critical (See Appendix E)

Table 4.17 shows that in the system analysis and design group of eleven tasks the graduates indicated the task, working with other programmers on problems, was the most important. The employers felt that two tasks, working with other programmers on a problem and working with systems analysts on a problem, were both ranked equally as the most important in the group. Graduates and employers placed the task, prepare a paper tape record layout, at the bottom of the group and the entire list of 75 tasks.

TABLE 4.18

RANKING OF TASKS PERFORMED IN PROGRAM DESIGN IN TERMS OF MASTERY OF THE TASK BY ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 2.00 | PROGRAM DESIGN | | | | | | | | |
| 2.08 | PREPARE A TEST DATA FOR PROGRAMS | 01. | 11.0 | 3.85 | 1.01 | 01. | 09.0 | 3.87 | 1.02 |
| 2.09 | SELECT APPROPRIATE DATA NAMES FOR DATA | 02. | 23.0 | 3.63 | 0.96 | 07. | 46.0 | 3.21 | 1.15 |
| 2.07 | USE STRUCTURED PROGRAMMING TECHNIQUES | 03. | 39.0 | 3.39 | 1.02 | 04. | 32.0 | 3.38 | 1.20 |
| 2.10 | SELECT FILE ORGANIZATION AND ACCESS METHODS FOR DATA FILES | 04. | 41.0 | 3.36 | 1.06 | 03. | 26.0 | 3.42 | 1.04 |
| 2.02 | PREPARE A GENERAL (LOGIC) PROGRAM FLOWCHART | 05. | 42.0 | 3.32 | 1.10 | 02. | 24.5 | 3.46 | 0.94 |
| 2.11 | SELECT APPROPRIATE PROGRAMMING LANGUAGE FOR PROBLEM | 06. | 48.0 | 3.17 | 1.25 | 09. | 64.5 | 2.74 | 1.22 |
| 2.01 | USE STANDARD FLOWCHART SYMBOLS | 07. | 50.5 | 3.15 | 1.10 | 06. | 44.5 | 3.22 | 1.04 |
| 2.03 | PREPARE A DETAIL PROGRAM FLOWCHART | 08.5 | 57.5 | 3.09 | 1.13 | 05. | 36.0 | 3.34 | 1.04 |
| 2.06 | DIVIDE A PROGRAM INTO MODULES | 08.5 | 57.5 | 3.09 | 1.11 | 08. | 47.0 | 3.19 | 1.07 |
| 2.05 | PREPARE A DECISION TABLE | 10. | 71.0 | 2.40 | 0.96 | 10. | 69.0 | 2.36 | 0.98 |
| 2.04 | PREPARE A GRID CHART | 11. | 74.0 | 1.77 | 0.78 | 11. | 74.0 | 2.12 | 0.87 |

*Mean: 1 = Slight 2 = Some 3 = Important 4 = Very 5 = Critical (See Appendix E)

In Table 4.18 we see both graduates and employers selecting the task, prepare test data for programs, as the most important one in the program design group of eleven tasks. Both graduates and employers rated the same two tasks as having minor importance. Prepare a grid chart received a rating of 11th by both groups and prepare a decision table received a rating of 10th. These two also were rated very low in the entire group of 75 tasks. Both groups rated prepare a grid chart as 74th in the item list. Prepare a decision table was rated 71st by graduates and 69th by employers.

TABLE 4.19

RANKING OF TASKS PERFORMED IN CODING IN TERMS OF MASTERY OF THE TASK BY ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 3.00 | CODING | | | | | | | | |
| 3.02 | WRITE HIGHER LEVEL LANGUAGE INSTRUCTIONS | 01. | 07.0 | 4.02 | 0.95 | 02. | 08.0 | 3.88 | 1.07 |
| 3.26 | USE CODING SHEETS | 02. | 08.0 | 3.97 | 1.11 | 01. | 07.0 | 3.90 | 1.03 |
| 3.20 | WRITE COMMENTS IN PROGRAM | 03. | 14.0 | 3.76 | 1.07 | 03. | 10.0 | 3.82 | 1.02 |
| 3.22 | WRITE EDIT ROUTINES | 04.5 | 15.5 | 3.75 | 0.91 | 04. | 15.5 | 3.63 | 0.81 |
| 3.16 | WRITE ERROR ROUTINES | 04.5 | 15.5 | 3.75 | 0.97 | 05. | 19.0 | 3.56 | 0.75 |
| 3.09 | WRITE SEQUENTIAL DISK FILE HANDLING ROUTINES | 06. | 18.5 | 3.70 | 0.87 | 07. | 22.5 | 3.47 | 0.97 |
| 3.10 | USE INDEX-SEQUENTIAL DISK FILE HANDLING ROUTINES | 07. | 21.0 | 3.65 | 0.89 | 06. | 21.0 | 3.50 | 0.89 |
| 3.17 | USE LIBRARY ROUTINES | 08.5 | 26.5 | 3.61 | 1.09 | 09.5 | 29.5 | 3.39 | 0.99 |
| 3.12 | USE TAPE FILE HANDLING ROUTINES | 08.5 | 26.5 | 3.61 | 1.04 | 12. | 34.0 | 3.37 | 0.83 |
| 3.05 | USE DISK SORT UTILITY ROUTINES | 10. | 28.0 | 3.59 | 1.02 | 09.5 | 29.5 | 3.39 | 0.90 |
| 3.15 | WRITE SUBROUTINES | 11. | 29.0 | 3.58 | 1.00 | 11. | 32.0 | 3.38 | 0.88 |
| 3.11 | USE RANDOM DISK FILE HANDLING ROUTINES | 12. | 31.0 | 3.50 | 0.97 | 15.5 | 42.5 | 3.23 | 0.98 |
| 3.21 | WRITE INSTRUCTIONS FOR INTERNAL/EXTERNAL CONTROLS | 13. | 33.0 | 3.48 | 1.09 | 15.5 | 42.5 | 3.23 | 1.01 |
| 3.07 | WRITE TABLE SEARCHING INSTRUCTIONS | 14. | 34.0 | 3.47 | 0.98 | 08. | 27.5 | 3.41 | 0.84 |
| 3.13 | USE CARD FILE HANDLING ROUTINES | 15.5 | 36.5 | 3.43 | 1.02 | 14. | 41.0 | 3.25 | 0.97 |
| 3.14 | USE DATA COMMUNICATIONS ROUTINES | 15.5 | 36.5 | 3.43 | 1.07 | 17.5 | 52.0 | 3.08 | 1.11 |
| 3.06 | WRITE TABLE BUILDING INSTRUCTIONS | 17. | 38.0 | 3.42 | 0.97 | 13. | 38.0 | 3.32 | 0.91 |
| 3.04 | USE TAPE SORT UTILITY ROUTINES | 18. | 50.5 | 3.15 | 1.16 | 19. | 56. | 3.04 | 0.97 |
| 3.19 | USE MACROS | 19. | 60.0 | 3.07 | 1.08 | 17.5 | 52.0 | 3.08 | 1.19 |
| 3.01 | WRITE ASSEMBLER LANGUAGE INSTRUCTIONS | 20. | 61.0 | 3.01 | 1.18 | 23. | 66.0 | 2.69 | 1.43 |
| 3.08 | WRITE TABLE SORTING INSTRUCTIONS | 21. | 64.0 | 2.91 | 1.07 | 21. | 63.0 | 2.79 | 0.96 |
| 3.18 | WRITE LIBRARY ROUTINES | 22. | 65.0 | 2.89 | 1.06 | 22. | 64.5 | 2.74 | 1.03 |
| 3.23 | WRITE CHECK DIGIT CHECKING ROUTINES | 23. | 66.0 | 2.87 | 1.10 | 25. | 68.0 | 2.54 | 0.94 |
| 3.03 | WRITE REPORT PROGRAM GENERATOR LANGUAGE INSTRUCTIONS | 24. | 67.0 | 2.84 | 1.35 | 20. | 59.0 | 2.98 | 1.35 |
| 3.24 | WRITE CHECK POINT-RESTART INSTRUCTIONS | 25. | 68.0 | 2.83 | 1.13 | 24. | 67.0 | 2.60 | 1.07 |
| 3.25 | WRITE FORM TEST PATTERN ROUTINES | 26. | 69.0 | 2.64 | 0.99 | 26. | 70.5 | 2.31 | 1.06 |

*Mean: 1 = Slight 2 = Some 3 = Important 4 = Very 5 = Critical (See Appendix E)

Table 4.19 indicates that among the twenty-six tasks within the coding group write higher level language instructions was the most important task in the opinion of the graduates. Employers rated use coding sheets as the most important task. These two tasks rated very high in the entire task list with the graduates and employers both ranking them 7th and 8th. Both graduates and employers ranked write form test pattern routines as the least important task in the group.

TABLE 4.20

RANKING OF TASKS PERFORMED IN TESTING AND DEBUGGING IN TERMS OF MASTERY OF THE TASK BY ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 4.00 | TESTING AND DEBUGGING | | | | | | | | |
| 4.04 | CORRECT LOGICAL ERRORS | 01. | 01.0 | 4.40 | 0.79 | 03. | 03.0 | 4.22 | 0.77 |
| 4.01 | READ A PROGRAM LISTING | 02. | 02.0 | 4.37 | 0.79 | 01. | 01.0 | 4.30 | 0.78 |
| 4.03 | CORRECT SYNTAX (CLERICAL) ERRORS | 03. | 03.0 | 4.16 | 0.90 | 04. | 04.0 | 4.10 | 0.92 |
| 4.02 | DESK CHECK A PROGRAM | 04. | 04.0 | 4.15 | 0.92 | 02. | 02.0 | 4.23 | 0.81 |
| 4.09 | TEST PROGRAM USING TEST DATA | 05. | 06.0 | 4.07 | 0.83 | 05. | 05.0 | 4.05 | 0.91 |
| 4.10 | TEST PROGRAM USING LIVE (USER) DATA | 06. | 09.0 | 3.95 | 0.97 | 06. | 06.0 | 3.95 | 1.04 |
| 4.07 | READ A FILE DUMP | 07. | 17.0 | 3.74 | 0.95 | 07. | 15.5 | 3.63 | 0.94 |
| 4.08 | READ A CROSS-REFERENCE LISTING | 08. | 18.5 | 3.70 | 1.03 | 08. | 22.5 | 3.47 | 0.99 |
| 4.06 | READ A MEMORY DUMP | 09. | 23.0 | 3.63 | 1.11 | 09. | 32.0 | 3.38 | 1.06 |
| 4.12 | RECOMMEND CORRECTIONS OR MODIFICATIONS TO PROGRAMS | 10. | 44.0 | 3.24 | 1.02 | 10. | 44.5 | 3.22 | 0.98 |
| 4.11 | EDIT PROGRAM FOR EFFECTIVE USE OF AUXILIARY STORAGE | 11. | 52.0 | 3.14 | 1.11 | 12. | 61.0 | 2.95 | 1.12 |
| 4.05 | READ A TRACE | 12. | 55.0 | 3.11 | 1.09 | 11. | 49.5 | 3.11 | 1.03 |

*Mean: 1 = Slight 2 = Some 3 = Important 4 = Very 5 = Critical (See Appendix E)

Table 4.20 indicates that all of the tasks in the testing and debugging were important to the beginning programmer. According to the graduates all of the tasks had an average value of over three of a possible five. The employers rated all above three except one at 2.95. The graduates rated correcting logical errors as the most important in the group and the entire task list. Employers picked reading a program listing as the most important in the group and the entire task list. Reading a trace was the least important task in the group according to the graduates with the employers rating edit program for effective use of auxiliary storage as the least important.

TABLE 4.21

RANKING OF TASKS PERFORMED IN DOCUMENTATION IN TERMS OF MASTERY OF THE TASK BY ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 5.00 | DOCUMENTATION | | | | | | | | |
| 5.02 | WRITE COMPUTER OPERATOR INSTRUCTIONS . . . . . | 01. | 13.0 | 3.77 | 0.96 | 01. | 17.0 | 3.61 | 1.01 |
| 5.03 | WRITE DOCUMENTATION UPDATES AFTER A PROGRAM REVISION . . . . . | 02. | 23.0 | 3.63 | 0.96 | 02. | 20.0 | 3.54 | 0.94 |
| 5.01 | PREPARE A PROGRAM DOCUMENTATION MANUAL . . . . . | 03. | 31.0 | 3.50 | 1.17 | 03. | 24.5 | 3.46 | 0.92 |
| 5.04 | SUMMARIZE THE CONTROLS IN PROGRAM TO DETECT ERRORS . . . . . | 04. | 46.5 | 3.18 | 1.09 | 04. | 39.0 | 3.29 | 0.95 |
| 5.05 | SUMMARIZE CALCULATIONS USED IN PROGRAM . . . . . | 05. | 55.0 | 3.11 | 1.05 | 05. | 40.0 | 3.26 | 0.91 |

*Mean: 1 = Slight 2 = Some 3 = Important 4 = Very 5 = Critical (See Appendix E)

Table 4.21 depicts both graduates and employers rating each item in the documentation group the same. The most important task was in the group, write computer operator instructions, and the least important was summarize calculations used in program. All five tasks had an average value of over three which indicates they were all important to a beginning programmer.

TABLE 4.22

RANKING OF MISCELLANEOUS TASKS PERFORMED IN TERMS OF MASTERY OF THE TASK BY ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 6.00 | MISCELLANEOUS | | | | | | | | |
| 6.06 | USE JOB CONTROL LANGUAGE (CONTROL CARDS) | 01. | 05.0 | 4.10 | 0.95 | 01. | 11.0 | 3.78 | 1.04 |
| 6.03 | PERFORM PROGRAM MAINTENANCE | 02. | 10.0 | 3.92 | 0.87 | 02. | 12.0 | 3.75 | 0.90 |
| 6.02 | PATCH COMPUTER PROGRAMS | 03. | 20.0 | 3.67 | 1.13 | 03. | 48.0 | 3.13 | 1.15 |
| 6.08 | PERFORM NUMBER SYSTEM ARITHMETIC | 04. | 45.0 | 3.23 | 1.15 | 05. | 58.0 | 3.00 | 1.08 |
| 6.09 | CONVERT NUMBERS BETWEEN NUMBER SYSTEMS | 05. | 49.0 | 3.16 | 1.22 | 04. | 54.0 | 3.07 | 1.16 |
| 6.05 | OPERATE COMPUTER FOR PROGRAM TESTS | 06. | 53.0 | 3.13 | 1.25 | 07. | 62.0 | 2.88 | 1.19 |
| 6.07 | USE VIRTUAL STORAGE TECHNIQUES | 07. | 59.0 | 3.08 | 1.22 | 06. | 60.0 | 2.96 | 0.98 |
| 6.01 | KEYPUNCH PROGRAM | 08. | 70.0 | 2.48 | 1.03 | 10. | 73.0 | 2.21 | 0.95 |
| 6.04 | CONVERT A PROGRAM TO ANOTHER LANGUAGE | 09. | 72.0 | 2.37 | 1.07 | 08. | 70.5 | 2.31 | 0.94 |
| 6.10 | PREPARE PRINTER CARRIAGE TAPE | 10. | 73.0 | 2.20 | 0.95 | 09. | 72.0 | 2.25 | 0.85 |

*Mean: 1 = Slight 2 = Some 3 = Important 4 = Very 5 = Critical (See Appendix E)

Table 4.22 indicates that among the ten tasks within the miscellaneous group, use job control language was the most important task in the opinion of both graduates and employers. This task also ranked very high in the entire task list (75 items), with graduates ranking it 5th and employers ranking it 11th. Performing program maintenance and patch computer programs were also rated as being very important by both employers and graduates. Prepare printer carriage tape was rated the least important in the miscellaneous group by graduates and ranked 9th in the group by employers. In the entire task list this task was rated 73rd by graduates and 72nd by employers. Two other tasks which were rated very low by both groups were: keypunch program and convert a program to another language.

Tables 4.23 through 4.28 deal with the future need (5 years) of the task over a range from greatly decrease, remain the same, to greatly increase the need for the task.

TABLE 4.23

RANKING OF TASKS PERFORMED IN SYSTEMS ANALYSIS AND DESIGN IN TERMS OF FUTURE NEED OF THE TASK FOR ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 1.00 | SYSTEMS ANALYSIS AND DESIGN | | | | | | | | |
| 1.03 | WORK WITH USERS ON PROBLEM | 01. | 11.5 | 3.77 | 0.94 | 04. | 19.0 | 3.56 | 1.04 |
| 1.05 | WORK WITH OTHER PROGRAMMERS ON PROBLEM | 02. | 14.0 | 3.71 | 0.86 | 03. | 13.0 | 3.64 | 0.73 |
| 1.01 | USE COMPANY SYSTEM STANDARDS | 03. | 20.0 | 3.67 | 1.03 | 01. | 09.0 | 3.69 | 1.11 |
| 1.04 | WORK WITH SYSTEMS ANALYST ON PROBLEM | 04. | 26.0 | 3.57 | 0.96 | 02. | 10.5 | 3.68 | 0.91 |
| 1.10 | PREPARE A DISK RECORD LAYOUT | 05. | 37.0 | 3.48 | 0.90 | 05. | 28.5 | 3.47 | 1.05 |
| 1.08 | PREPARE A PRINTER SPACING FORM | 06. | 42.0 | 3.35 | 0.75 | 06. | 41.0 | 3.28 | 0.95 |
| 1.06 | PREPARE A SYSTEM FLOWCHART | 07. | 44.5 | 3.33 | 0.99 | 08. | 46.0 | 3.14 | 1.06 |
| 1.02 | WRITE A DETAILED DESCRIPTION OF A PROBLEM. | 08. | 49.0 | 3.30 | 1.07 | 07. | 43.0 | 3.22 | 1.26 |
| 1.09 | PREPARE A TAPE RECORD LAYOUT | 09. | 52.0 | 3.18 | 0.91 | 09. | 55.0 | 2.99 | 1.06 |
| 1.07 | PREPARE A CARD RECORD LAYOUT | 10. | 59.5 | 3.02 | 0.98 | 10. | 60.0 | 2.87 | 1.03 |
| 1.11 | PREPARE A PAPER TAPE RECORD LAYOUT | 11. | 75.0 | 1.77 | 1.03 | 11. | 75.0 | 1.87 | 1.10 |

*Mean: 1 = Very Low 2 = Low 3 = No Change 4 = High 5 = Very High (See Appendix E)

Table 4.23 shows that in the system analysis and design group of eleven tasks the graduate indicated two tasks, work with users on problem and work with other programmers on problem, would increase in need in the next five years. Employers felt the task most likely to increase in need was use company standards. Both graduates and employers thought that the need for preparing a paper tape record layout would decrease in the future. They also rated it 75th in the entire item list of 75 items.

TABLE 4.24

RANKING OF TASKS PERFORMED IN PROGRAM DESIGN IN TERMS OF FUTURE NEED OF THE TASK FOR ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 2.00 | PROGRAM DESIGN | | | | | | | | |
| 2.08 | PREPARE A TEST DATA FOR PROGRAMS | 01.5 | 08.5 | 3.79 | 0.93 | 01. | 02.0 | 3.81 | 0.86 |
| 2.07 | USE STRUCTURED PROGRAMMING TECHNIQUES | 01.5 | 08.5 | 3.79 | 1.09 | 02. | 08.0 | 3.71 | 1.13 |
| 2.09 | SELECT APPROPRIATE DATA NAMES FOR DATA | 03. | 33.5 | 3.51 | 0.85 | 03. | 24.0 | 3.49 | 0.86 |
| 2.02 | PREPARE A GENERAL (LOGIC) PROGRAM FLOWCHART | 04. | 39.0 | 3.45 | 1.00 | 06. | 44.0 | 3.21 | 0.94 |
| 2.10 | SELECT FILE ORGANIZATION AND ACCESS METHODS FOR DATA FILES | 05. | 44.5 | 3.33 | 1.00 | 04. | 30.0 | 3.40 | 1.03 |
| 2.06 | DIVIDE A PROGRAM INTO MODULES | 06. | 47.5 | 3.31 | 1.23 | 05. | 36.0 | 3.34 | 1.11 |
| 2.01 | USE STANDARD FLOWCHART SYMBOLS | 07. | 50.0 | 3.28 | 0.93 | 07. | 50.0 | 3.08 | 0.92 |
| 2.03 | PREPARE A DETAIL PROGRAM FLOWCHART | 08. | 54.0 | 3.13 | 1.07 | 08. | 53.5 | 3.01 | 1.02 |
| 2.11 | SELECT APPROPRIATE PROGRAMMING LANGUAGE FOR PROBLEM | 09. | 67.0 | 2.75 | 1.23 | 09. | 63.0 | 2.76 | 1.10 |
| 2.05 | PREPARE A DECISION TABLE | 10. | 71.0 | 2.52 | 1.05 | 10. | 68.0 | 2.64 | 1.03 |
| 2.04 | PREPARE A GRID CHART | 11. | 74.0 | 2.04 | 0.95 | 11. | 74.0 | 2.32 | 0.99 |

*Mean: 1 = Very Low 2 = Low 3 = No Change 4 = High 5 = Very High (See Appendix E)

Table 4.24 shows the graduates indicating two tasks, prepare test data for programs and use structured programming techniques, as having the greatest future need in the program design group of eleven items. They also rated these two very high on the entire list with a rank of 8.5. The employers also ranked prepare test data for program as number one in the group and number two in the entire list of 75 items. They also rated use structured programming techniques as 2nd in the group and 8th in the entire list. Prepare a grid chart was ranked last in the group and second to last in the entire list by both graduates and employers.

TABLE 4.25

RANKING OF TASKS PERFORMED IN CODING IN TERMS OF FUTURE NEED OF THE TASK FOR ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 3.00 | CODING | | | | | | | | |
| 3.02 | WRITE HIGHER LEVEL LANGUAGE INSTRUCTIONS | 01. | 07.0 | 3.80 | 1.00 | 02. | 03.5 | 3.79 | 0.94 |
| 3.20 | WRITE COMMENTS IN PROGRAM | 02. | 10.0 | 3.78 | 0.96 | 03. | 10.5 | 3.68 | 0.82 |
| 3.14 | USE DATA COMMUNICATIONS ROUTINES | 03. | 15.0 | 3.70 | 1.11 | 01. | 01.0 | 3.83 | 0.91 |
| 3.22 | WRITE EDIT ROUTINES | 04.5 | 17.0 | 3.69 | 0.96 | 05. | 22.0 | 3.53 | 0.71 |
| 3.16 | WRITE ERROR ROUTINES | 04.5 | 17.0 | 3.69 | 0.88 | 06. | 24.0 | 3.49 | 0.72 |
| 3.15 | WRITE SUBROUTINES | 06.5 | 22.5 | 3.64 | 0.93 | 04. | 19.0 | 3.56 | 0.87 |
| 3.17 | USE LIBRARY ROUTINES | 06.5 | 22.5 | 3.64 | 1.05 | 07. | 26.5 | 3.48 | 0.89 |
| 3.05 | USE DISK SORT UTILITY ROUTINES | 08. | 24.0 | 3.63 | 0.94 | 12. | 35.0 | 3.35 | 0.80 |
| 3.10 | USE INDEX-SEQUENTIAL DISK FILE HANDLING ROUTINES | 09. | 27.0 | 3.56 | 1.01 | 10. | 33.0 | 3.37 | 0.83 |
| 3.11 | USE RANDOM DISK FILE HANDLING ROUTINES | 10.5 | 30.0 | 3.54 | 1.03 | 08.5 | 31.5 | 3.39 | 0.81 |
| 3.09 | WRITE SEQUENTIAL DISK FILE HANDLING ROUTINES | 10.5 | 30.0 | 3.54 | 0.98 | 15. | 40.0 | 3.30 | 0.76 |
| 3.26 | USE CODING SHEETS | 12. | 33.5 | 3.51 | 0.97 | 13.5 | 38.0 | 3.32 | 0.83 |
| 3.07 | WRITE TABLE SEARCHING INSTRUCTIONS | 13.5 | 37.0 | 3.48 | 0.89 | 08.5 | 31.5 | 3.39 | 0.69 |
| 3.06 | WRITE TABLE BUILDING INSTRUCTIONS | 13.5 | 37.0 | 3.48 | 0.91 | 11. | 34.0 | 3.36 | 0.68 |
| 3.21 | WRITE INSTRUCTIONS FOR INTERNAL/EXTERNAL CONTROLS | 15. | 40.0 | 3.43 | 1.09 | 13.5 | 38.0 | 3.32 | 0.88 |
| 3.12 | USE TAPE FILE HANDLING ROUTINES | 16. | 41.0 | 3.36 | 1.08 | 18. | 53.5 | 3.01 | 0.85 |
| 3.18 | WRITE LIBRARY ROUTINES | 17. | 53.0 | 3.14 | 1.03 | 16. | 47.0 | 3.13 | 1.01 |
| 3.19 | USE MACROS | 18. | 56.0 | 3.09 | 1.11 | 17. | 52.0 | 3.03 | 1.04 |
| 3.04 | USE TAPE SORT UTILITY ROUTINES | 19. | 57.0 | 3.07 | 1.15 | 23. | 64.5 | 2.74 | 1.02 |
| 3.13 | USE CARD FILE HANDLING ROUTINES | 20. | 59.5 | 3.02 | 1.06 | 22. | 62.0 | 2.78 | 0.71 |
| 3.08 | WRITE TABLE SORTING INSTRUCTIONS | 21. | 61.0 | 3.00 | 0.95 | 20. | 58.0 | 2.92 | 0.90 |
| 3.24 | WRITE CHECK POINT-RESTART INSTRUCTIONS | 22. | 63.0 | 2.93 | 1.06 | 19. | 56.0 | 2.97 | 1.10 |
| 3.23 | WRITE CHECK DIGIT CHECKING ROUTINES | 23. | 64.0 | 2.88 | 1.05 | 24. | 67.0 | 2.67 | 0.94 |
| 3.01 | WRITE ASSEMBLER LANGUAGE INSTRUCTIONS | 24. | 66.0 | 2.79 | 1.16 | 25. | 69.0 | 2.62 | 1.23 |
| 3.25 | WRITE FORM TEST PATTERN ROUTINES | 25. | 68.0 | 2.65 | 0.98 | 26. | 70.0 | 2.57 | 1.01 |
| 3.03 | WRITE REPORT PROGRAM GENERATOR LANGUAGE INSTRUCTIONS | 26. | 69.0 | 2.63 | 1.29 | 21. | 59.0 | 2.89 | 1.19 |

*Mean: 1 = Very Low 2 = Low 3 = No Change 4 = High 5 = Very High (See Appendix E)

Table 4.25 indicates that in the opinion of the graduates, write higher level language instructions, had the greatest future need. They also placed it high in the entire list with a rank of 7th. The employers felt that the task use data communications routines had the greatest future need in the group and the entire list of tasks. Employers thought write higher level language instructions also had a great future need ranking it 2nd in the group and 3.5 in the entire list (75 items). The task which the graduates felt had the least future need in the group was write report program generator language instructions with the employers picking write form test pattern routine as last.

TABLE 4.26

RANKING OF TASKS PERFORMED IN TESTING AND DEBUGGING IN TERMS OF FUTURE NEED OF THE TASK FOR ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 4.00 | TESTING AND DEBUGGING | | | | | | | | |
| 4.04 | CORRECT LOGICAL ERRORS | 01. | 01.0 | 3.99 | 0.91 | 02. | 05.0 | 3.77 | 0.84 |
| 4.01 | READ A PROGRAM LISTING | 02. | 02.0 | 3.96 | 0.91 | 04. | 07.0 | 3.74 | 0.86 |
| 4.02 | DESK CHECK A PROGRAM | 03. | 03.0 | 3.93 | 0.88 | 01. | 03.5 | 3.79 | 0.85 |
| 4.09 | TEST PROGRAM USING TEST DATA | 04. | 04.5 | 3.89 | 0.86 | 03. | 06.0 | 3.75 | 0.83 |
| 4.10 | TEST PROGRAM USING LIVE (USER) DATA. | 05. | 17.0 | 3.69 | 0.92 | 05. | 13.0 | 3.64 | 0.91 |
| 4.03 | CORRECT SYNTAX (CLERICAL) ERRORS | 06. | 19.0 | 3.68 | 0.97 | 06. | 19.0 | 3.56 | 0.91 |
| 4.07 | READ A FILE DUMP | 07. | 25.0 | 3.62 | 0.89 | 08. | 26.5 | 3.48 | 0.74 |
| 4.12 | RECOMMEND CORRECTIONS OR MODIFICATIONS TO PROGRAMS | 08. | 28.0 | 3.55 | 0.93 | 07. | 24.0 | 3.49 | 0.77 |
| 4.06 | READ A MEMORY DUMP | 09. | 30.0 | 3.54 | 1.01 | 10. | 45.0 | 3.18 | 0.97 |
| 4.08 | READ A CROSS-REFERENCE LISTING | 10. | 32.0 | 3.53 | 0.91 | 09. | 42.0 | 3.27 | 0.84 |
| 4.11 | EDIT PROGRAM FOR EFFECTIVE USE OF AUXILIARY STORAGE. | 11. | 47.5 | 3.31 | 1.07 | 11. | 48.5 | 3.11 | 0.94 |
| 4.05 | READ A TRACE | 12. | 55.0 | 3.10 | 1.00 | 12. | 51.0 | 3.07 | 0.91 |

*Mean: 1 = Very Low 2 = Low 3 = No Change 4 = High 5 = Very High (See Appendix E)

Table 4.25 shows that graduates and employers felt all the tasks in the testing and debugging group would have increased future need in the next five years. The graduates picked correct logical errors as the task having most future need both in the testing and debugging group and the entire task list. They also placed read a program listing and desk check a program very high in the group and the item list with a rank of two and three in both. The employers selected desk check a program as having the most future need in the group and placed it 3.5 in the entire list. Both graduates and employers placed read a trace at the bottom of the group for future need.

TABLE 4.27

RANKING OF TASKS PERFORMED IN DOCUMENTATION IN TERMS OF FUTURE NEED OF THE TASK FOR ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 5.00 | DOCUMENTATION | | | | | | | | |
| 5.02 | WRITE COMPUTER OPERATOR INSTRUCTIONS | 01. | 06.0 | 3.84 | 0.87 | 03. | 17.0 | 3.58 | 0.89 |
| 5.03 | WRITE DOCUMENTATION UPDATES AFTER A PROGRAM REVISION | 02. | 13.0 | 3.75 | 0.90 | 02. | 15.0 | 3.63 | 0.86 |
| 5.01 | PREPARE A PROGRAM DOCUMENTATION MANUAL | 03. | 21.0 | 3.66 | 0.99 | 01. | 13.0 | 3.64 | 0.97 |
| 5.04 | SUMMARIZE THE CONTROLS IN PROGRAM TO DETECT ERRORS | 04. | 43.0 | 3.34 | 1.03 | 04. | 28.5 | 3.47 | 0.86 |
| 5.05 | SUMMARIZE CALCULATIONS USED IN PROGRAM | 05. | 51.0 | 3.22 | 0.97 | 05. | 38.0 | 3.32 | 0.96 |

*Mean: 1 = Very Low 2 = Low 3 = No Change 4 = High 5 = Very High (See Appendix E)

Table 4.27 points out that in the documentation group of five items, the task showing the greatest future need in the opinion of the graduates was write computer operator instructions. Employers rated prepare a program documentation manual as having the greatest future need in the group. Write computer operator instructions was also rated very high in the entire item list of 75 items. Both groups placed summarize calculations used in program last in the group for future need.

TABLE 4.28

RANKING OF MISCELLANEOUS TASKS PERFORMED IN TERMS OF FUTURE NEED OF THE TASK FOR ENTRY LEVEL PROGRAMMERS

| ITEM NO. | TASK DESCRIPTION | GRADUATE GROUP RANK | GRADUATE ITEM RANK | GRADUATE MEAN* | GRADUATE S D | EMPLOYER GROUP RANK | EMPLOYER ITEM RANK | EMPLOYER MEAN* | EMPLOYER S D |
|---|---|---|---|---|---|---|---|---|---|
| 6.00 | MISCELLANEOUS | | | | | | | | |
| 6.06 | USE JOB CONTROL LANGUAGE (CONTROL CARDS) | 01. | 04.5 | 3.89 | 1.03 | 02. | 21.0 | 3.55 | 0.98 |
| 6.03 | PERFORM PROGRAM MAINTENANCE | 02. | 11.5 | 3.77 | 0.87 | 01. | 16.0 | 3.59 | 0.73 |
| 6.02 | PATCH COMPUTER PROGRAMS | 03. | 35.0 | 3.50 | 1.11 | 04. | 57.0 | 2.95 | 1.16 |
| 6.07 | USE VIRTUAL STORAGE TECHNIQUES | 04. | 46.0 | 3.32 | 1.28 | 03. | 48.5 | 3.11 | 1.26 |
| 6.08 | PERFORM NUMBER SYSTEM ARITHMETIC | 05. | 58.0 | 3.06 | 1.08 | 05. | 61.0 | 2.84 | 0.95 |
| 6.09 | CONVERT NUMBERS BETWEEN NUMBER SYSTEMS | 06. | 62.0 | 2.97 | 1.18 | 06. | 64.5 | 2.74 | 0.99 |
| 6.05 | OPERATE COMPUTER FOR PROGRAM TESTS | 07. | 65.0 | 2.84 | 1.24 | 07. | 66.0 | 2.69 | 0.98 |
| 6.04 | CONVERT A PROGRAM TO ANOTHER LANGUAGE | 08. | 70.0 | 2.58 | 1.11 | 10. | 73.0 | 2.42 | 1.12 |
| 6.01 | KEYPUNCH PROGRAM | 09. | 72.0 | 2.41 | 1.00 | 09. | 72.0 | 2.44 | 0.91 |
| 6.10 | PREPARE PRINTER CARRIAGE TAPE | 10. | 73.0 | 2.28 | 1.00 | 08. | 71.0 | 2.48 | 0.97 |

*Mean: 1 = Very Low 2 = Low 3 = No Change 4 = High 5 = Very High (See Appendix E)

In table 4.28 the graduates selected use job control language in the miscellaneous group of ten items as having the greatest future need. The employers selected perform program maintenance as the first task in the list. Prepare printer carriage tape was chosen by the graduates as having the least future need in the miscellaneous group. The employers placed convert a program to another language at the end of the list. Both graduates and employers put prepare printer carriage tape very low in the entire list of 75 items giving it a rank of 73.

The respondents were asked to list under other tasks in the survey instrument any tasks that were not included. Refer to Appendixes K and L for a list of these tasks. Working with CRT's was the only task mentioned by several graduates.

Follow-Up Interviews

Twenty-six graduates and twenty-one employers were interviewed with the assistance of an interview guide (refer to Appendixes G and H) so that all questions were covered as equally as possible. The responses to the questions asked during the interview are summarized on the following pages. The first seventeen questions were the same for both groups and will be summarized together. The last two questions will be discussed separately for graduates and employers.

| | Summary Graduate Response | Summary Employer Response |
|---|---|---|
| 1. What company standards are used by entry-level programmers? | None = 3<br>Standards Manual = 8<br>Standard Forms = 8<br>Documentation Standards = 4<br>Naming Conventions For:<br>Programs = 4<br>Files = 5<br>Data = 3<br>Follow Company Standards Policy = 4<br>Comments = 2<br>Use Standard Utilities Suggestions = 3<br>Have to Use COBOL = 1 | None = 2<br>Standards Manual = 4<br>Standard Forms = 2<br>Documentation Standards = 4<br>Naming Conventions For:<br>Programs = 5<br>Files = 4<br>Data = 3<br>Criteria For Dates = 1<br>Supervisor Check Beginners and Makes Suggestions = 1 |
| 2. How do entry-level programmers interact with the following people in the company? USERS | Never = 5<br>Rarely = 4<br>Manner:<br>Formal & Informal = Many<br>Phone = 3<br>Meetings = 4<br>Personal Visits = 12<br>Discuss Test Results = 1 | Never = 3<br>Rarely = 6<br>Manner:<br>Formal & Informal = Many<br>Phone = 1<br>Meetings = 2<br>Personal Visits = 6<br>Discuss Test Results = 1 |

| | Summary Graduate Response | Summary Employer Response |
|---|---|---|
| 2. (Continued) | | |
| ANALYST | Never = 2<br>Informal Discussions = 11<br>Analyst Assigns Work and Gives Directions = 1<br>Meetings = 1<br>Analyst Provides General System Design & Layout = 1<br>Charts = 8 | Never = 2<br>Informal Discussions = 11<br>Analyst Assigns Work = 1<br>Programmer Work as Analyst = 2<br>Work on Teams = 1 |
| PROGRAMMER | Never = 2<br>Informal Interchange = 13<br>Project Teams = 2<br>Courses = 1 | Never = 4<br>Informal Interchange = 11<br>Project Teams = 2<br>Formal Meetings = 1 |
| 3. Are there visual display units (CRT's) in any part of the environment? If yes, what are special skills needed in working on this VDU (CRT)? | Yes = 10<br>No = 16<br><br>Be able to read manual | Yes = 9<br>No = 12<br><br>Learn CICS--know concepts = 1<br>Screen Formatting = 1<br>Data Communications Knowledge = 1 |
| 4. Are beginning programmers required to use structured programming? | Yes = 6<br>No = 18 | Yes = 2<br>No = 19 |
| <u>If yes</u>, what is done in structured programming? | Top-Bottom Flow = 1<br>Minimal Use of Go To Shells = 1<br>Book Format Documentation (Chapters) = 1 | Top-Down Concept = 1<br>Minimal Use of Go To Condense Main Line = 1<br>Programs Follow Same Basic Pattern Structure = 1 |

| | Summary Graduate Response | Summary Employer Response |
|---|---|---|
| 4. Continued | | |
| If no, do you think structured programming will be required in the foreseeable future? | Yes = 5<br>No = 13 | Yes = 4<br>No = 15 |
| 5. What file organization and access methods are used? | Consecutive = 11<br>Sequential = 25<br>Index Sequential = 22<br>Random (Direct) = 19<br>Virtual = 1<br>Others:<br>Batch Files = 1<br>Chain Files = 1 | Consecutive = 8<br>Sequential = 20<br>Index Sequential = 15<br>Random (Direct) = 18<br>Virtual = 2<br>Others:<br>PTS (NCR) = 1<br>Total = 1<br>Will Replace ISAM = 1 |
| 6. Do entry-level programmers work with outside software? | Yes = 13<br>No = 13 | Yes = 5<br>No = 16 |
| If yes, what skills needed? What types of modifications, etc., are done? | Minor = 1<br>Updates provided = 1<br>Modify package for user application = 1 | Understanding = 1<br>Very limited = 1 |
| 7. Are data-base packages used? | Yes = 5<br>No = 21 | Yes = 6<br>No = 15 |
| If yes, which one? | IMS = 1<br>Forte (Burroughs) = 1 | IMS & IDMS = 1<br>Forte (Burroughs) = 1 |
| 8. What kinds of edits are entry level programmers required to use? | Test for: Numeric, alphabetic, duplicate record, positive, negative, validity, zero = 1 | Follows Program Definition = 1 |

| | Summary Graduate Response | Summary Employer Response |
|---|---|---|
| 8. Continued | Totals: Batch & Others<br>Valid Codes<br>Limit Checks, Range Check, Required Fields, Check Digit, Cross Checking Files, Error Conditions, Date, Audit Trails, Valid Printer Characters = 1 | |
| 9. How do beginning programmers do printer alignment in programs? | Line Counts = Many<br>Standard Carriage Tape = Many<br>Dummy Forms = 1 | Line Counts = Many<br>Standard Carriage Tape = Many<br>Operator Instructions = 1 |
| 10. Do entry-level programmers provide restart points in their programs? | Yes = 18<br>No = 8 | Yes = 7<br>No = 14 |
| If yes, how? | Control Cards = 1<br>Specific Key (Field) = 1 | Control Cards = 1<br>Key Record = 1 |
| 11. Do entry-level programmers use application or detailed line-handling routines for data communications equipment? | Application = 7<br>Detailed Line-Handling = 2<br>No = 17 | Application = 3<br>Detailed Line-Handling = 2<br>No = 15 |
| 12. What techniques do entry-level programmers use in desk checking? | 80-80 List Check<br>Check Cards<br>Manually Step Through Program<br>Trace and Core Dump<br>Cross Reference Listing<br>Check with Other Programmers | Boss Check Code<br>Check Off List<br>Check Programs With Known Results |

| | Summary Graduate Response | Summary Employer Response |
|---|---|---|
| 13. What are the most common syntax and logic errors made by entry-level programmers? | Spelling Errors<br>Punctuation<br>Keypunch Errors<br>Forgot to Define Field<br>Missing Instruction<br>Loops<br>Missing Periods (COBOL) | Field Length |
| 14. What is the policy or practice on nested if's? | Not Permitted = 17<br>Very Limited = 6<br>Use Them = 3 | Not Permitted = 13<br>Very Limited = 3 |
| 15. What are entry-level programmers required to do in the way of documentation? | Operator Instruction Sheets<br>Flowcharts<br>Many Comments<br>Sample Printed Report<br>Specification Sheets<br>Definitions (Program, File, etc.)<br>Error Message Sheet<br>Layouts (Printer, File, etc.)<br>Source Listing | Operator Instruction Sheets<br>Flowcharts<br>Many Comments<br>Sample Printed Report<br>Specification Sheets<br>Definitions (Program, File, etc.)<br>Layouts (Printer, File, etc.)<br>Source Listing<br>User Instructions |
| How is documentation organized? | Folders<br>3-Ring Binders<br>Manual<br>Book of Layouts | Folders<br>3-Ring Binders<br>Manual<br>Bound Listings<br>Job Documentation Package |

| | Summary Graduate Response | Summary Employer Response |
|---|---|---|
| 16. What problems do entry-level programmers encounter in program maintenance that differs from when they are developing a program? | Follow Other Programmers LOGIC = 18<br>Forecasting Future Needs<br>Not Having The Most Recent Listing | Follow Other Programmers LOGIC= 12<br>Looking at Entire Program For Ramifications |
| 17. What are the major applications that entry-level programmers write programs for? | Accounts Receivable = 10<br>Accounts Payable = 7<br>Inventory = 13<br>Payroll = 7<br>Sales-Commission = 5<br>Accounting = 6<br>Banking<br>Miscellaneous | Accounts Receivable = 12<br>Accounts Payable = 7<br>Inventory = 6<br>Payroll = 7<br>Sales-Commission = 3<br>Accounting = 9<br>Banking<br>Miscellaneous |

The graduates were asked the question: What were the things, subjects, experiences, etc., from your two years in school that benefitted you the most? In their opinion the graduates felt the following had been the most beneficial:

| | | | |
|---|---|---|---|
| Programming Courses and Skills | = 10 | System Classes | = 2 |
| Accounting Courses | = 6 | Data Processing Club | = 2 |
| Hands On | = 4 | Different Languages | = 1 |
| Communication Skills | = 3 | | |

Graduates listed the following programming and other skills that were lacking when they started work:

| | | |
|---|---|---|
| Computer Operations = 3 | Work On Other People's Programs |
| None = 2 | Background on IBM Machines |
| Math | Background on Burroughs Machines |
| Debugging | Accounting |
| Applications | Teleprocessing |
| Documentation | |

The employers were asked: What impressed you most about the graduates? The answers received were:

| | |
|---|---|
| Well Rounded D.P. Education | = 5 |
| Hard Workers | = 5 |
| Good Accounting Background | = 3 |
| Very Competitive | = 3 |
| Could Write Programs Immediately | = 2 |
| On-The-Job Training At School | |
| Good Documentation | |
| Logical Deduction Ability | |

Employers listed the following as skills needed most by our graduates:

| | |
|---|---|
| None | = 4 |
| Experience (Programming and Operations) | |
| General Business Knowledge | |
| System Analysis and Design | |
| Structured Programming | |
| JCL | |
| Data Communications (On Line T.P.) | |
| School Should Update Equipment | |

# CHAPTER V

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

On the basis of the findings in chapter four, the following conclusions are drawn from the study:

1. Both graduates and employers tended to rank the four areas--frequency, performance, importance, and future need--the same for all six groups of tasks, especially at the high and low ends of the groups.

2. The following tasks were listed in the top fifteen in all four areas by both graduates and employers: Read a program listing, Desk check a program, Correct logical errors, Test program using test data, Write comments in program.

3. Six tasks that ranked in the last eight positions in the entire list of seventy-five items were: Prepare a paper tape record layout, Prepare a grid chart, Prepare a decision table, Prepare a printer carriage tape, Convert a program to another language, and Write form test pattern routines.

4. The interviews indicated that many businesses are using or are considering an on-line system in the near future.

5. It would appear, based on the results of both the mailed questionnaire and the personal interviews, that the Vocational, Technical and Adult Education system is currently emphasizing the proper tasks needed for entry-level programmers.

6. Many employers indicated that operations experience was very important to being a successful entry-level programmer (refer to Appendix J and Q).

Recommendations

Based on the study the author makes the following recommendations:

1. Due to the changing nature of data processing, studies of this nature should be conducted every five years.

2. Curriculum studies like Gateway Technical Institute, Kenosha, is conducting to determine the relevancy of the data processing curriculum presently being taught in VTAE schools in the State of Wisconsin should be stressed. The data collected in this study should be used as input to studies of the type being done at Gateway.

3. Technical Institutes training entry-level programmers in the survey's population area should review their course content using the results of this study as a guide to be sure that tasks high on the list are emphasized and tasks low on the list are dropped or de-emphasized.

4. VTAE districts conducting data processing programming programs should place considerable emphasis on the following entry-level programming skills:

read a program listing
desk check a program
correct logical errors
test program using test data
write comments

5. VTAE districts conducting data processing programming programs should place high emphasis on the following entry-level program skills:

work with other programmers on problem
use company systems standards
select appropriate data names for data
use coding sheets
correct syntax (clerical) errors
use job control language
write higher level language instructions

6. VTAE districts conducting data processing programming programs should minimize emphasis on the following entry-level programming skills:

prepare a paper tape record layout
prepare a grid chart
prepare a decision table
prepare a printer carriage tape
convert a program to another language
write form test pattern routines

7. VTAE districts conducting data processing programming programs should include a knowledge of on-line systems in their curriculum.

8. Data processing students should have some operating experience on their school's computer. This would help them better understand the operating system of the computer and operator run procedures.

9. Local advisory committees should be wisely used to determine the entry-level programming skills necessary to succeed as a programmer in a community. This could be done in the manner advisory committee members were used to assist in piloting this study.

10. Related research studies should be conducted in the data processing programmer entry-level skills area such as:

A study to determine the correlation between employees' and employers' opinions of necessary entry-level skills.

A study to determine if different entry programming skills are necessary to succeed in a large data processing installation vs. a small one.

# A P P E N D I X

APPENDIX A

ORIGINAL TASK LIST

TASKS LIST

1.00 SYSTEMS ANALYSIS

1.01 Write a detailed description of a problem.

1.02 Communicate a problem with users.

1.03 Communicate a problem with a systems analyst.

1.04 Communicate a problem with users.

1.05 Prepare a system flowchart.

1.06 Prepare a card record layout.

1.07 Prepare a printer spacing form.

1.08 Prepare a tape record layout.

1.09 Prepare a disk record layout.

1.10 Prepare a paper tape record layout.

1.11 Other _____

1.12 Other _____

1.13 Other _____

2.00 PROGRAM DESIGN

2.01 Use all standard flowchart symbols.

2.02 Prepare a general (logic) program flowchart.

2.03 Prepare a detail program flowchart.

2.04 Prepare a grid chart.

2.05 Prepare a decision table.

2.06 Divide a program into modules (segmentation).

2.07 Use structured programming techniques.

2.08 Prepare test data for programs.

2.09 Select appropriate data names for data.

2.10 Select file organization and access methods for data files.

2.00 PROGRAM DESIGN (Continued)

2.11 Select appropriate programming language to be used for problem.

2.12 Other _____

2.13 Other _____

2.14 Other _____

3.00 CODING

3.01 Write machine language instructions.

3.02 Write assembler language instructions.

3.03 Write higher level language instructions.

3.04 Write report program generator language instructions.

3.05 Write input instructions.

3.06 Write output instructions.

3.07 Write data transfer instructions.

3.08 Write arithmetic instructions.

3.09 Write decision making instructions.

3.10 Write unconditional branch instructions.

3.11 Use tape sort utility routines.

3.12 Write tape sort routines.

3.13 Use disk sort utility routines.

3.14 Write disk sort routines.

3.15 Write table building instructions.

3.16 Write table searching instructions.

3.17 Write table sorting instructions.

3.18 Write sequential disk file handling routines.

3.19 Use index-sequential disk file handling routines.

3.20 Write index-sequential disk file handling routines.

3.21 Use random disk file handling routines.

3.22 Write random disk file handling routines.

3.00 CODING (Continued)

3.23 Use tape file handling routines.

3.24 Write tape file handling routines.

3.25 Use card file handling routines.

3.26 Write card file handling routines.

3.27 Write data communications instructions.

3.28 Write subroutines.

3.29 Write error routines.

3.30 Use library routines.

3.31 Write library routines.

3.32 Write address modification instructions.

3.33 Use macros.

3.34 Write macros.

3.35 Write comments in program.

3.36 Write instructions for internal controls.

3.37 Write instructions for external controls.

3.38 Write edit routines.

3.39 Write check digit checking routines.

3.40 Write check point-restart instructions.

3.41 Write form test pattern routines.

3.42 Use coding sheets.

3.43 Use efficient coding.

3.44 Other _____

3.45 Other _____

3.46 Other _____

4.00 TESTING AND DEBUGGING

4.01 Read a program listing.

4.02 Desk check a program.

4.03 Correct syntax (clerical) errors.

4.04 Correct logical errors.

4.05 Read a trace.

4.06 Read a snapshot dump.

4.07 Read a memory dump.

4.08 Read a file dump.

4.09 Read a cross-reference listing.

4.10 Test program using test data.

4.11 Test program using live (user) data.

4.12 Use cross reference listing.

4.13 Edit programs for effective use of primary storage.

4.14 Edit programs for effective use of secondary storage.

4.15 Edit programs for efficiency of compiler generated code.

4.16 Recommend corrections or modifications to programs.

4.17 Other _____

4.18 Other _____

4.19 Other _____

5.00 DOCUMENTATION

5.01 Prepare a program documentation manual.

5.02 Write computer operator instructions required to run program.

5.03 Write program updates after a revision.

5.04 Summarize the controls built into the program to detect errors.

5.05 Summarize calculations used in program.

5.06 Other _____

5.00 DOCUMENTATION (Continued)

5.07 Other _____

5.08 Other _____

6.00 AUXILIARY OR MISCELLANEOUS

6.01 Provide control cards for program.

6.02 Keypunch program.

6.03 Patch computer programs.

6.04 Perform program maintenance.

6.05 Convert a program to another language.

6.06 Operate computer for program tests.

6.07 Use job control language (JCL).

6.08 Use virtual storage techniques.

6.09 Use number systems.

6.10 Understand operating system.

6.11 Other _____

6.12 Other _____

6.13 Other _____

APPENDIX B

LETTER TO EMPLOYEE RECEIVING SURVEY INSTRUMENT

State of Wisconsin \ BOARD OF VOCATIONAL, TECHNICAL & ADULT EDUCATION

EUGENE LEHRMANN
State Director
4802 Sheboygan Avenue
MADISON, WISCONSIN 53702

February 16, 1976

Dear Graduate:

The Vocational, Technical and Adult Education System in Wisconsin is conducting a statewide research study aimed at identifying job tasks, performance levels, general education, and other learning experiences as they relate to data processing programmers. District One and Gateway Technical Institutes have been designated to conduct this study as a cooperative project. The results of this study will be used to revise and update the data processing program in an effort to prepare people better for the world of work.

As a graduate of an associate degree data processing program, your assistance would be of great value. We would greatly appreciate your taking about twenty minutes to complete the enclosed questionnaire and return it, together with the informational cover sheet, in the enclosed, self-addressed envelope. If your position does not involve programming, please answer only the questions on the informational cover sheet and return.

If you have any questions concerning the survey, please call Joseph N. Kettner, District One Technical Institute-Eau Claire, 715-836-3933.

In an effort to obtain an even better analysis of needed program changes, we would also like to receive input from your supervisor if he/she supervises people that do programming. With this in mind, would you please give the other questionnaire packet to your supervisor and ask that he/she complete and return it.

The results of this survey will be furnished to you upon your request.

Sincerely,

Eugene Lehrmann

Eugene Lehrmann
State Director

EL:go

Enclosures

APPENDIX C

FOLLOW-UP LETTER TO EMPLOYEE RECEIVING SURVEY INSTRUMENT

# DISTRICT ONE TECHNICAL INSTITUTE - EAU CLAIRE

620 WEST CLAIREMONT AVENUE
EAU CLAIRE, WISCONSIN 54701

March 3, 1976

Dear Graduate:

Approximately two weeks ago you were sent a questionnaire relating to a study being conducted by District One and Gateway Technical Institutes. At this time we have not yet received your response.

It is of vital importance to the reliability of this study that we receive a response from you. With this in mind, we have enclosed copies of a questionnaire for you as well as one for your employer to complete (see explanation on enclosed cover letters).

In the event that you have already returned the original questionnaire, please ignore this reminder. If you did not have an opportunity to complete the original questionnaire, please complete the one which is enclosed and return it by March 16, 1976.

I sincerely appreciate the time you have given to the completion of the questionnaire.

Sincerely,

Joseph N. Kettner Jr.

Joseph N. Kettner, Jr.
Principal Research Investigator

sb

Enclosures



BRANCH OF AREA VOCATIONAL, TECHNICAL AND ADULT EDUCATION DISTRICT ONE
NORBERT K. WURTZEL, DISTRICT DIRECTOR

APPENDIX D

LETTER TO EMPLOYER RECEIVING SURVEY INSTRUMENT

State of Wisconsin \ BOARD OF VOCATIONAL, TECHNICAL & ADULT EDUCATION

EUGENE LEHRMANN
State Director
4802 Sheboygan Avenue
MADISON, WISCONSIN 53702

February 16, 1976

Dear Employer/Supervisor:

The Vocational, Technical and Adult Education System in Wisconsin is conducting a statewide research study aimed at identifying job tasks, performance levels, general education, and other learning experiences as they relate to data processing programmers. District One and Gateway Technical Institutes have been designated to conduct this study as a cooperative project. The results of this study will be used to revise and update the data processing program in an effort to prepare people better for the world of work.

As a supervisor of a graduate(s) of an associate degree data processing program, your assistance would be of great value. We would greatly appreciate your taking about twenty minutes in order to complete the attached questionnaire and return it, together with the informational cover sheet, in the enclosed, self-addressed envelope. We have asked one of our graduates who is employed under your supervision to seek your cooperation. This employee, through an interest in upgrading his/her occupation/profession, is also cooperating with us in this study.

If you have any questions concerning the survey, please call Joseph N. Kettner, District One Technical Institute-Eau Claire, 715-836-3933.

The results of this survey will be furnished to you upon your request.

Sincerely,

Eugene Lehrmann

Eugene Lehrmann
State Director

EL:go

Enclosures

APPENDIX E

INFORMATIONAL COVER SHEET FOR SURVEY INSTRUMENT

District One (Eau Claire) and Gateway (Kenosha) Technical Institutes February, 1976

# ENTRY LEVEL PROGRAMMER TASK INVENTORY

## DEFINITIONS FOR SURVEY RATINGS

**Frequency**

1=Never..... Not performed by entry level programmer.
2=< Monthly. Performed less than monthly (bi-monthly, quarterly, etc.) by entry level programmer.
3=Monthly... Performed monthly by entry level programmer.
4=Weekly.... Performed weekly by entry level programmer.
5=Daily..... Performed daily by entry level programmer.

**Performance**

1=Very Low.. Merely assists others in performing this task.
2=Low..... Performs task satisfactorily with constant supervision and some assistance.
3=Average... Performs this task satisfactorily with limited supervision.
4=High..... Performs this task satisfactorily without assistance or supervision.
5=Very High. Performs this task satisfactorily without assistance or supervision and can lead others in performing this task.

**Importance**

1=Slight.... Mastery of this task is only slightly important for entry level employment.
2=Some..... Mastery of this task is of some importance for entry level employment.
3=Important. Mastery of this task is important for entry level employment.
4=Very..... Mastery of this task is very important for entry level employment.
5=Critical.. Mastery of this task is critical for entry level employment.

**Future Need**

1=Very Low.. Need for task will decrease greatly during the next five years.
2=Low..... Need for task will decrease during the next five years.
3=No Change. Need for task will remain the same for the next five years.
4=High..... Need for task will increase during the next five years.
5=Very High. Need for task will increase greatly during the next five years.

* * * \

# ENTRY LEVEL PROGRAMMER TASK INVENTORY

DIRECTIONS: Carefully read each task statement and respond as it would relate to any entry level programmer where you work. In making this response, circle a "1" (Never) under the FREQUENCY column if the task is not performed by entry level programmers and proceed to column (D) FUTURE NEED. If the task is performed by entry level programmers, please complete all four columns.

At the end of each group, list and rate any other tasks which are performed.

| | | A FREQUENCY 1=Never 2=< Monthly 3=Monthly 4=Weekly 5=Daily | B PERFORMANCE 1=Very Low 2=Low 3=Average 4=High 5=Very High | C IMPORTANCE 1=Slight 2=Some 3=Important 4=Very 5=Critical | D FUTURE NEED 1=Very Low 2=Low 3=No Change 4=High 5=Very High |
|---|---|---|---|---|---|
| 1.00 | SYSTEMS ANALYSIS AND DESIGN | | | | |
| 1.01 | Use company system standards . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 1.02 | Write a detailed description of a problem. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 1.03 | Work with users on problem . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 1.04 | Work with systems analyst on problem . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 1.05 | Work with other programmers on problem . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 1.06 | Prepare a system flowchart . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 1.07 | Prepare a card record layout . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 1.08 | Prepare a printer spacing form . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 1.09 | Prepare a tape record layout . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 1.10 | Prepare a disk record layout . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 1.11 | Prepare a paper tape record layout . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 1.12 | Other_____ | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 2.00 | PROGRAM DESIGN | | | | |
| 2.01 | Use standard flowchart symbols . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 2.02 | Prepare a general (logic) program flowchart. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 2.03 | Prepare a detail program flowchart . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 2.04 | Prepare a grid chart . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 2.05 | Prepare a decision table . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 2.06 | Divide a program into modules. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 2.07 | Use structured programming techniques. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 2.08 | Prepare a test data for programs . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |

| ENTRY LEVEL PROGRAMMER TASK INVENTORY | FREQUENCY<br>1=Never<br>2=< Monthly<br>3=Monthly<br>4=Weekly<br>5=Daily | PERFORMANCE<br>1=Very Low<br>2=Low<br>3=Average<br>4=High<br>5=Very High | IMPORTANCE<br>1=Slight<br>2=Some<br>3=Important<br>4=Very<br>5=Critical | FUTURE NEED<br>1=Very Low<br>2=Low<br>3=No Change<br>4=High<br>5=Very High |
|---|---|---|---|---|
| 2.00 PROGRAM DESIGN (Continued) | | | | |
| 2.09 Select appropriate data names for data . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 2.10 Select file organization & access methods for data files | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 2.11 Select appropriate programming language for problem. . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 2.12 Other_____ | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.00 CODING | | | | |
| 3.01 Write assembler language instructions. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.02 Write higher level language instructions . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.03 Write report program generator language instructions . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.04 Use tape sort utility routines . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.05 Use disk sort utility routines . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.06 Write table building instructions. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.07 Write table searching instructions . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.08 Write table sorting instructions . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.09 Write sequential disk file handling routines . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.10 Use index-sequential disk file handling routines . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.11 Use random disk file handling routines . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.12 Use tape file handling routines. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.13 Use card file handling routines. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.14 Use data communications routines . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.15 Write subroutines. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.16 Write error routines . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.17 Use library routines . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.18 Write library routines . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.19 Use macros . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.20 Write comments in program. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.21 Write instructions for internal/external controls. . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |

ENTRY LEVEL PROGRAMMER TASK INVENTORY

| | | FREQUENCY<br>1=Never<br>2=< Monthly<br>3=Monthly<br>4=Weekly<br>5=Daily | PERFORMANCE<br>1=Very Low<br>2=Low<br>3=Average<br>4=High<br>5=Very High | IMPORTANCE<br>1=Slight<br>2=Some<br>3=Important<br>4=Very<br>5=Critical | FUTURE NEED<br>1=Very Low<br>2=Low<br>3=No Change<br>4=High<br>5=Very High |
|---|---|---|---|---|---|
| 3.00 | CODING (Continued) | | | | |
| 3.22 | Write edit routines. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.23 | Write check digit checking routines. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.24 | Write check point-restart instructions . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.25 | Write form test pattern routines . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.26 | Use coding sheets. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.27 | Other_____ | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 4.00 | TESTING AND DEBUGGING | | | | |
| 4.01 | Read a program listing . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 4.02 | Desk check a program . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 4.03 | Correct syntax (clerical) errors . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 4.04 | Correct logical errors . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 4.05 | Read a trace . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 4.06 | Read a memory dump . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 4.07 | Read a file dump . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 4.08 | Read a cross-reference listing . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 4.09 | Test program using test data . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 4.10 | Test program using live (user) data. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 4.11 | Edit program for effective use of auxiliary storage. . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 4.12 | Recommend corrections or modifications to programs . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 4.13 | Other_____ | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 5.00 | DOCUMENTATION | | | | |
| 5.01 | Prepare a program documentation manual . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 5.02 | Write computer operator instructions . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 5.03 | Write documentation updates after a program revision . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 5.04 | Summarize the controls in program to detect errors . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 5.05 | Summarize calculations used in program . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 5.06 | Other_____ | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |

## ENTRY LEVEL PROGRAMMER TASK INVENTORY

| | | FREQUENCY<br>1=Never<br>2= <Monthly<br>3=Monthly<br>4=Weekly<br>5=Daily | PERFORMANCE<br>1=Very Low<br>2=Low<br>3=Average<br>4=High<br>5=Very High | IMPORTANCE<br>1=Slight<br>2=Some<br>3=Important<br>4=Very<br>5=Critical | FUTURE NEED<br>1=Very Low<br>2=Low<br>3=No Change<br>4=High<br>5=Very High |
|---|---|---|---|---|---|
| 6.00 | MISCELLANEOUS | | | | |
| 6.01 | Keypunch program . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 6.02 | Patch computer programs. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 6.03 | Perform program maintenance. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 6.04 | Convert a program to another language. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 6.05 | Operate computer for program tests . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 6.06 | Use job control language (Control Cards) . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 6.07 | Use virtual storage techniques . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 6.08 | Perform number system arithmetic . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 6.09 | Convert numbers between number systems . . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 6.10 | Prepare printer carriage tape. . . . . | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 6.11 | Other_____ | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |

* * * \

GRADUATE

APPENDIX G

GRADUATE INTERVIEW GUIDE

DISTRICT ONE TECHNICAL INSTITUTE
ENTRY LEVEL PROGRAMMER COMPETENCIES INTERVIEW GUIDE

NAME _____

COMPANY NAME _____

1. What company standards do you use in your job? (Ask for the 5 most important ones - examples)

_____

_____

_____

_____

_____

_____ NONE

2. How do you interact with the following people in your company? (Give examples)

   a. Users

   _____

   _____

   _____

   b. Analysts

   _____

   _____

   _____

   c. Other Programmers

   _____

   _____

   _____

3. Do you have any visual display units (CRT) in any part of your environment?

____ YES ____ NO

If yes, what are some special programming skills that you need when working on the VDU (CRT)?

_____

_____

_____

_____

_____

4. Are you required to or do you use structured programming? ____ YES ____ NO

If yes, would you briefly explain what you are doing in structured programming?

_____

_____

_____

_____

If no, do you think you will be required to use structured programming in the foreseeable future? ____ YES ____ NO

5. What file organization and access methods do you use in your shop?

_____ Consecutive (Unordered - No Key)

_____ Sequential

_____ Index Sequential

_____ Random (Direct)

_____ Virtual (Storage Access Method)(VSAM)

_____ Others

Indicate the one used most often.

6. Do you use outside software? ____ YES ____ NO

   If yes, what skills do you need to use outside software?

   What types of modifications, etc., are done?

7. Are you using any data-base package? ____ YES ____ NO

   If yes, which one? _____

   How involved? _____

8. What kind of edits are you doing? Give examples.

9. How do you do printer alignment in your programs?

10. Do you provide restart points in your programs? ____ YES ____ NO

    If yes, how?

11. Do you use application or detailed line-handling routines for data communications equipment? Example - formating on VDU (CRT)

12. What techniques do you use in desk checking?

13. What are the most common syntax and logic errors you make?

14. What is the policy or practice on nested if's?

15. What do you do in the way of documentation?

How is it organized?

16. What problems do you encounter in program maintenance that differ from when you are writing a program?

17. What are the major applications that you write programs for?

18. What were the things, subjects, experiences, etc., from your two years in school that benefited you the most?

19. What programming or other skills do you feel you were lacking when you first started work?



THANK YOU

3/15/76

EMPLOYER/SUPERVISOR

APPENDIX H

EMPLOYER INTERVIEW GUIDE

DISTRICT ONE TECHNICAL INSTITUTE
ENTRY LEVEL PROGRAMMER COMPETENCIES INTERVIEW GUIDE

NAME _____

COMPANY NAME _____

1. What company standards are used by entry level programmers? (Ask for the 5 most important ones - examples)

_____

_____

_____

_____

_____

_____ NONE

2. How do entry level programmers interact with the following people in your company? (Give examples)

   a. Users

   _____

   _____

   _____

   b. Analysts

   _____

   _____

   _____

   c. Other Programmers

   _____

   _____

   _____

3. Do you have any visual display units (CRT) in any part of your environment?

____ YES ____ NO

If yes, what are some special programming skills that an entry level programmer would need to use the VDU (CRT)?

_____

_____

_____

_____

_____

4. Are your entry level programmers required to use structured programming?

___ YES ____ NO

If yes, would you briefly explain what they do in structured programming?

_____

_____

_____

_____

If no, do you think they will be required to use structured programming in the foreseeable future? ____ YES ____ NO

5. What file organization and access methods do you use in your shop?

_____ Consecutive (Unordered - No Key)

_____ Sequential

_____ Index Sequential

_____ Random (Direct)

_____ Virtual (Storage Access Method) (VSAM)

_____ Others

Indicate the one used most often.

6. Do entry level programmers work with outside software? ____ YES ____ NO

If yes, what skills do entry level programmers need to use outside software?

What types of modifications do they make?

7. Do entry level programmers use any data-base packages? ____ YES ____ NO

If yes, which one? _____

How involved? _____

8. What kind of edits are entry level programmers required to use? Give examples.

9. How do entry level programmers do printer alignment in their programs?

10. Do entry level programmers provide restart points in their programs?
____ YES ____ NO

If yes, how?

11. Do entry level programmers use application or detailed line-handling routines for data communications equipment? Example - formating on VDU (CRT)

12. What techniques do entry level programmers use in desk checking?

13. What are the most common syntax and logic errors made by entry level programmers?

14. What is the policy or practice on nested if's?

15. What are entry level programmers required to do in the way of documentation?

How is it organized?

16. What problems do your entry level programmers encounter in program maintenance that differs from when they are writing a program?

17. What are the major applications that your entry level programmers write programs for?

18. What impressed you most about our graduates?

19. What skills are our graduates in need of most?

THANK YOU

3/15/76

GRADUATE

APPENDIX I

SUMMARY OF GRADUATE ANSWERS TO INTERVIEW

DISTRICT ONE TECHNICAL INSTITUTE
ENTRY LEVEL PROGRAMMER COMPETENCIES INTERVIEW GUIDE

NAME 26 interviewed

COMPANY NAME

1. What company standards do you use in your job? (Ask for the 5 most important ones - examples)

Use Standards Manual (8) — Naming Conventions for:

Standard Forms (8) — Programs (4), Files (5), and Data (3)

Documentation Standards (4) — Use Standard Utilities

Follow Company Standards Policy (4) — Suggestions (3)

Comments (2) — Have to Use COBOL

3 NONE

2. How do you interact with the following people in your company? (Give examples)

a. Users No = 5 Rarely = 4

Discussion (formal and informal) — Personal Visit (12)

Phone (3) — Discuss Test Results

Meetings (4)

b. Analysts No = 3

Informal Frequent Discussions (11) — Analyst Provides Gen. System

Meetings — Design & Layout Charts (8)

Analyst Assigns Work and Gives Direction

c. Other Programmers Rarely = 2

Mostly Informal Interchange (13)

Project Teams (2)

Courses

3. Do you have any visual display units (CRT) in any part of your environment?

10 YES 16 NO

If yes, what are some special programming skills that you need when working on the VDU (CRT)?

Be able to read manual.

4. Are you required to or do you use structured programming? 6 YES 18 NO

If yes, would you briefly explain what you are doing in structured programming?

Top-Bottom Flow Minimal Use of Go To

Shells

Book Format Documentation (Chapters)

If no, do you think you will be required to use structured programming in the foreseeable future? 5 YES 13 NO

5. What file organization and access methods do you use in your shop?

11 Consecutive (Unordered - No Key)

25 Sequential

22 Index Sequential

19 Random (Direct)

1 Virtual (Storage Access Method)(VSAM)

X Others Batch File and Chain Files

Indicate the one used most often.

6. Do you use outside software? 13 YES 13 NO

If yes, what skills do you need to use outside software?

What types of modifications, etc., are done?

Minor

Updates Provided By Software House

Modify Package For User Application

7. Are you using any data-base package? 5 YES 21 NO

If yes, which one? IMS and FORTE (Burroughs)

How involved?

8. What kind of edits are you doing? Give examples.

Test for Numeric, Alphabetic, Duplicate Record, Positive, Negative, Validity, Zero, Totals Batch and Others, Valid Codes, Limit Checks, Range Checks, Required Fields, Check Digits, Cross Checking Files, Error Conditions, Date, Audit Trails, Valid Printer Character

9. How do you do printer alignment in your programs?

Line Counts

Standard Carriage Tape

Dummy Forms

10. Do you provide restart points in your programs? 18 YES 8 NO

If yes, how?

Control Cards

Specify Key (Field)

11. Do you use application (7) or detailed line-handling (2) routines for data communications equipment? Example - formating on VDU (CRT)

No - 17

12. What techniques do you use in desk checking?

80-80 List Check
Check Cards
Manually Step Through Program
Trace
Core Dumps (Some)
Cross Reference Listing
Check With Other Programmers

13. What are the most common syntax and logic errors you make?

Spelling Errors
Punctuation
Keypunch Errors
Forget To Define Field
Missing Instruction
Loops
Missing Periods (COBOL)

14. What is the policy or practice on nested if's?

Do Not Use (17)
6 said very limited
3 use

15. What do you do in the way of documentation?

Operator Instruction Sheets (Run Manual)
Flowcharts
Error Message Sheet
Many Comments
Specification Sheets
Samples of Printed Report
Program Definitions

How is it organized?

Folders

3 Ring Binders

Manuals

Book of Layouts

16. What problems do you encounter in program maintenance that differ from when you are writing a program?

Following Other Programmers Logic (18)

Forecasting Future Needs

Not Having the Most Recent Program Listing

17. What are the major applications that you write programs for?

| | |
|---|---|
| Accounts Receivable (10) | Sales-Commission (5) |
| Accounts Payable (7) | Accounting (6) |
| Inventory (13) | Banking |
| Payroll (7) | Miscellaneous |

18. What were the things, subjects, experiences, etc., from your two years in school that benefited you the most?

| | |
|---|---|
| Programming Courses and Skills (9) | Different Languages |
| Hands On (4) | Data Processing Club (2) |
| Accounting Courses (6) | System Classes (2) |
| Communication Skills (3) | |

19. What programming or other skills do you feel you were lacking when you first started work?

| | | |
|---|---|---|
| None (2) | Work On Other People's Programs | |
| Computer Operations (3) | Background in IBM Machines | |
| Math | Background in Burroughs Machines | |
| Debugging | Accounting | |
| Applications | Teleprocessing | Documentation |

THANK YOU

3/15/76

EMPLOYER/SUPERVISOR

APPENDIX J

SUMMARY OF EMPLOYER ANSWERS TO INTERVIEW

DISTRICT ONE TECHNICAL INSTITUTE
ENTRY LEVEL PROGRAMMER COMPETENCIES INTERVIEW GUIDE

NAME 21 interviewed

COMPANY NAME

1. What company standards are used by entry level programmers? (Ask for the 5 most important ones - examples)

Standards Manual (4)

Standard Forms (2)

Documentation Standards (4)

Naming Conventions for:

Programs (5), Files (4), Data (3)

2 NONE

Criteria for Dates Standard

Supervisor Checks Beginner's Programs and Makes Suggestions

2. How do entry level programmers interact with the following people in your company? (Give examples)

a. Users No = 3 Rarely = 6

Discussion (formal and informal)

Phone

Meetings (2)

Personal Visits (6)

Discuss Test Results

b. Analysts No = 2

Informal Discussions (11)

Programmers Also Work as Analysts (2)

Work on Teams

Analysts Assign Work

c. Other Programmers Rarely = 4

Frequent Informal Interchange (11)

Formal Meetings

Work on Teams (2)

3. Do you have any visual display units (CRT) in any part of your environment?

__9__ YES __12__ NO

If yes, what are some special programming skills that an entry level programmer would need to use the VDU (CRT)?

Learn CICS - know Concepts

Screen Formatting

Data Communications Knowledge

4. Are your entry level programmers required to use structured programming?

__2__ YES __19__ NO

If yes, would you briefly explain what they do in structured programming?

Top-Down Concept, Minimal Use of Go To, Condense Main Line

Programs Follow Same Basic Pattern Structure

If no, do you think they will be required to use structured programming in the foreseeable future? __4__ YES __15__ NO

5. What file organization and access methods do you use in your shop?

__8__ Consecutive (Unordered - No Key)

__20__ Sequential

__15__ Index Sequential

__18__ Random (Direct)

__2__ Virtual (Storage Access Method) (VSAM)

__3__ Others Total, PFS (NCR), Will Replace ISAM

Indicate the one used most often.

6. Do entry level programmers work with outside software? 5 YES 16 NO

If yes, what skills do entry level programmers need to use outside software?

What types of modifications do they make?

Very limited

7. Do entry level programmers use any data-base packages? 6 YES 15 NO

If yes, which one? IMS, IDMS, FORTE (Burroughs)

How involved?

8. What kind of edits are entry level programmers required to use? Give examples.

Follows program definition

9. How do entry level programmers do printer alignment in their programs?

Line Counts

Standard Carriage Tape

Operator Instructions

10. Do entry level programmers provide restart points in their programs?
7 YES 14 NO

If yes, how?

Key Record

Control Card

11. Do entry level programmers use application (3) or detailed line-handling routines (2) for data communications equipment? Example - formating on VDU (CRT)

No = 15

12. What techniques do entry level programmers use in desk checking?

Boss Checks Code

Check Off List

Check Program Against Known Results

13. What are the most common syntax and logic errors made by entry level programmers?

Field Length

14. What is the policy or practice on nested if's?

No = 13

Very Limited = 3

15. What are entry level programmers required to do in the way of documentation?

Operator Instruction Sheets (13)

Definitions (Files, Programs)

Flowcharts

Layouts (Printer, Files, Cards, etc.)

Source Listing

Job Card Specifications

Many Comments

Sample Reports

User Instructions

How is it organized?

3 Ring Binders — Manuals

Folders (Documentation)

Bound Listings

Job Documentation Package

16. What problems do your entry level programmers encounter in program maintenance that differs from when they are writing a program?

Following Other Programmers Logic (12)

Looking at Entire Program for Ramification

17. What are the major applications that your entry level programmers write programs for?

Accounts Receivable (12) — Sales-Commission (3)

Accounts Payable (7) — Accounting (9)

Inventory (6) — Banking

Payroll (7) — Miscellaneous

18. What impressed you most about our graduates?

Well Rounded D. P. Education (5) — Good Accounting Background (3)

Could Write Programs Immediately (2) — On-the-Job Training at School

Hard Workers (5) — Good Documentation

Very Competitive (3) — Logical Deduction Ability

19. What skills are our graduates in need of most? None = 4

Experience (Programming and Operations) — JCL

General Business Knowledge — Data Communications (On Line T.P.)

Systems Analysis and Design

Structured Programming

School Should Update Equipment

THANK YOU 3/15/76

APPENDIX K

GRADUATE ANSWERS TO OTHER TASKS ON SURVEY INSTRUMENT

1.00 SYSTEMS ANALYSIS AND DESIGN:
- Mag. ledger (MMR).
- Knowledge of programming terms.
- CRT layouts.
- Graphics display layout.
- Communicate effectively (informal talk, meetings, presentations).
- Terminal screen layouts.
- Prepare diskette layout.
- Prepare operator run sheet.
- Know limitations of languages.
- Data record layout (Table Generation).
- Teleprocessing.
- Prepare memory storage layouts.

2.00 PROGRAM DESIGN:
- When to use multi-languages.
- Efficient core utilization.
- Use various software packages.

3.00 CODING:
- VSAM file handling.
- Use data base software (IMS).
- Use CRT for remote job entry.
- Access the data base.
- Write programs for CRT's.

4.00 TESTING AND DEBUGGING:
- Data selection (Good Correlation).
- Check results with user.

5.00 DOCUMENTATION:
- Organize documentation.
- Edit check documentation.
- Technical report writing.
- Write CRT operator instructions.
- Record of data modifications.
- Communicate with user via memos.

6.00 MISCELLANEOUS:
- Wire boards (410, 510, 402).
- Know full capabilities of your utilities.
- Assist in operations.
- Work overtime.

APPENDIX L

EMPLOYER ANSWERS TO OTHER TASKS ON SURVEY INSTRUMENT

1.00 SYSTEMS ANALYSIS AND DESIGN:
- Write a purpose and intent paragraph.
- Prepare memory record layout.
- Detailed description of system.
- Read/understand a card, disk, tape layout.
- Understanding of data base managers.
- Interview user.
- Prepare table layouts.
- Give a design presentation to users and/or project team.

2.00 PROGRAM DESIGN:
- Description of design.
- Make decision of structure vs. non-structure, modular vs. non-modular depending upon system requirements and available resources.

3.00 CODING:
- None.

4.00 TESTING AND DEBUGGING:
- Perform program modifications.

5.00 DOCUMENTATION:
- None.

6.00 MISCELLANEOUS:
- Boolean logic - switching functions.

APPENDIX M

GRADUATE SURVEY RESPONSES BY FREQUENCY COUNT

District One (Eau Claire) and Gateway (Kenosha) Technical Institutes February, 1976

# ENTRY LEVEL PROGRAMMER TASK INVENTORY

DIRECTIONS: Carefully read each task statement and respond as it would relate to any entry level programmer where you work. In making this response, circle a "1" (Never) under the FREQUENCY column if the task is not performed by entry level programmers and proceed to column (D) FUTURE NEED. If the task is performed by entry level programmers, please complete all four columns.

At the end of each group, list and rate any other tasks which are performed.

| | | A FREQUENCY 1=Never 2=< Monthly 3=Monthly 4=Weekly 5=Daily | B PERFORMANCE 1=Very Low 2=Low 3=Average 4=High 5=Very High | C IMPORTANCE 1=Slight 2=Some 3=Important 4=Very 5=Critical | D FUTURE NEED 1=Very Low 2=Low 3=No Change 4=High 5=Very High |
|---|---|---|---|---|---|
| 1.00 | SYSTEMS ANALYSIS AND DESIGN | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 1.01 | Use company system standards . . . . . | 9 11 13 25 76 | 3 7 70 15 10 | 9 16 52 20 19 | 7 8 41 49 29 |
| 1.02 | Write a detailed description of a problem. . . . . | 42 37 25 20 11 | 5 23 45 22 3 | 10 24 31 25 9 | 10 11 53 34 17 |
| 1.03 | Work with users on problem . . . . . | 23 36 23 22 23 | 4 13 50 27 13 | 5 15 35 40 22 | 3 5 44 47 33 |
| 1.04 | Work with systems analyst on problem . . . . . | 17 14 24 25 43 | 4 11 40 44 9 | 4 6 44 29 24 | 3 4 37 29 24 |
| 1.05 | Work with other programmers on problem . . . . . | 3 12 15 29 66 | 0 7 45 36 32 | 2 9 43 31 20 | 2 2 37 45 28 |
| 1.06 | Prepare a system flowchart . . . . . | 34 33 21 7 10 | 8 15 43 29 12 | 9 26 42 21 9 | 7 13 37 29 16 |
| 1.07 | Prepare a card record layout . . . . . | 23 35 20 20 6 | 4 8 44 29 22 | 9 19 34 21 14 | 15 10 73 26 8 |
| 1.08 | Prepare a printer spacing form . . . . . | 11 21 42 29 11 | 1 8 29 53 22 | 3 19 40 29 16 | 3 4 78 26 9 |
| 1.09 | Prepare a tape record layout . . . . . | 44 26 27 19 5 | 3 7 29 28 15 | 6 14 43 19 12 | 8 10 65 12 8 |
| 1.10 | Prepare a disk record layout . . . . . | 30 29 23 25 9 | 3 7 27 28 22 | 3 15 41 20 21 | 4 5 64 27 19 |
| 1.11 | Prepare a paper tape record layout . . . . . | 121 9 2 1 0 | 19 3 10 4 1 | 24 7 6 2 1 | 60 14 27 4 3 |
| 1.12 | Other_____ | 5 2 2 2 6 | 0 2 3 6 3 | 0 1 3 4 5 | 3 0 2 4 9 |
| 2.00 | PROGRAM DESIGN | | | | |
| 2.01 | Use standard flowchart symbols . . . . . | 11 28 29 32 27 | 3 7 29 39 19 | 10 26 44 25 15 | 6 9 74 26 16 |
| 2.02 | Prepare a general (logic) program flowchart. . . . . | 13 33 41 40 10 | 2 9 35 60 18 | 5 24 47 27 24 | 7 5 64 33 23 |
| 2.03 | Prepare a detail program flowchart . . . . . | 24 42 24 17 10 | 3 7 40 46 15 | 9 27 30 25 15 | 13 12 64 26 15 |
| 2.04 | Prepare a grid chart . . . . . | 109 18 5 1 0 | 10 13 17 2 1 | 30 19 7 1 0 | 67 30 46 3 0 |
| 2.05 | Prepare a decision table . . . . . | 87 24 9 3 1 | 6 14 27 9 3 | 18 27 16 8 1 | 29 23 39 12 4 |
| 2.06 | Divide a program into modules. . . . . | 44 41 27 17 6 | 4 13 44 27 6 | 8 20 32 25 10 | 18 8 37 43 20 |
| 2.07 | Use structured programming techniques. . . . . | 28 16 29 30 41 | 4 6 48 37 16 | 4 14 48 28 18 | 8 3 37 48 40 |
| 2.08 | Prepare a test data for programs . . . . . | 8 23 29 31 29 | 8 9 44 34 23 | 4 8 36 44 41 | 3 3 24 28 36 |

| ENTRY LEVEL PROGRAMMER TASK INVENTORY | FREQUENCY<br>1=Never<br>2=< Monthly<br>3=Monthly<br>4=Weekly<br>5=Daily | PERFORMANCE<br>1=Very Low<br>2=Low<br>3=Average<br>4=High<br>5=Very High | IMPORTANCE<br>1=Slight<br>2=Some<br>3=Important<br>4=Very<br>5=Critical | FUTURE NEED<br>1=Very Low<br>2=Low<br>3=No Change<br>4=High<br>5=Very High |
|---|---|---|---|---|
| | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 2.00 PROGRAM DESIGN (Continued) | | | | |
| 2.09 Select appropriate data names for data . . . . . | 6 8 19 40 60 | 0 5 36 57 27 | 0 15 44 30 30 | 1 5 72 29 23 |
| 2.10 Select file organization & access methods for data files | 60 30 23 37 13 | 6 11 43 25 9 | 5 15 29 34 13 | 9 8 55 20 14 |
| 2.11 Select appropriate programming language for problem. . | 66 21 5 10 10 | 6 8 14 18 10 | 8 8 19 14 10 | 29 10 30 19 10 |
| 2.12 Other_____ | 1 0 1 2 1 | 0 1 1 1 0 | 0 1 1 1 0 | 0 0 2 2 1 |
| 3.00 CODING | | | | |
| 3.01 Write assembler language instructions. . . . . | 79 23 8 6 19 | 7 13 24 15 10 | 8 17 20 10 0 | 22 30 30 19 10 |
| 3.02 Write higher level language instructions . . . . . | 30 11 11 14 75 | 3 4 26 43 27 | 1 7 33 41 42 | 5 3 41 44 36 |
| 3.03 Write report program generator language instructions . | 80 17 5 [illegible] 25 | 9 6 27 16 8 | 13 19 14 12 11 | 24 16 40 10 11 |
| 3.04 Use tape sort utility routines . . . . . | 60 19 25 17 12 | 5 7 30 31 10 | 8 15 31 18 13 | 17 8 61 10 16 |
| 3.05 Use disk sort utility routines . . . . . | 16 10 25 34 31 | 1 4 43 44 26 | 2 14 42 34 27 | 3 5 57 37 28 |
| 3.06 Write table building instructions. . . . . | 10 13 40 27 32 | 2 8 43 35 6 | 4 13 53 25 19 | 4 6 62 20 19 |
| 3.07 Write table searching instructions . . . . . | 8 23 43 20 32 | 1 9 47 30 19 | 3 14 52 26 23 | 3 8 62 20 19 |
| 3.08 Write table sorting instructions . . . . . | 62 22 25 10 5 | 3 15 35 16 9 | 9 17 33 16 6 | 10 17 63 23 7 |
| 3.09 Write sequential disk file handling routines . . . . . | 12 14 42 27 20 | 2 1 43 26 21 | 2 4 47 47 24 | 7 3 56 42 23 |
| 3.10 Use index-sequential disk file handling routines . . . | 20 20 23 20 25 | 2 7 30 27 18 | 2 4 48 20 22 | 7 4 52 40 25 |
| 3.11 Use random disk file handling routines . . . . . | 26 22 20 21 16 | 4 11 43 25 11 | 2 12 40 23 18 | 6 11 42 45 23 |
| 3.12 Use tape file handling routines. . . . . | 20 12 22 25 24 | 3 5 26 44 19 | 4 9 27 23 25 | 8 20 57 24 23 |
| 3.13 Use card file handling routines. . . . . | 11 20 20 20 23 | 2 5 29 34 25 | 3 19 46 25 23 | 11 25 57 23 13 |
| 3.14 Use data communications routines . . . . . | 55 27 14 16 15 | 3 17 28 19 11 | 2 13 20 18 16 | 7 6 25 27 23 |
| 3.15 Write subroutines. . . . . | 24 19 24 25 20 | 3 11 23 40 17 | 2 12 25 24 21 | 6 6 48 45 25 |
| 3.16 Write error routines . . . . . | 10 12 20 48 25 | 1 3 42 36 23 | 2 8 42 41 23 | 2 2 29 20 29 |
| 3.17 Use library routines . . . . . | 27 20 21 22 24 | 3 6 42 29 20 | 4 13 23 23 28 | 7 5 44 42 29 |
| 3.18 Write library routines . . . . . | 75 20 15 11 5 | 5 11 22 14 6 | 5 23 24 13 6 | 11 13 57 20 11 |
| 3.19 Use macros . . . . . | 26 21 17 16 19 | 9 10 20 22 10 | 8 13 26 17 9 | 15 12 22 20 12 |
| 3.20 Write comments in program. . . . . | 7 13 19 26 30 | 3 6 27 24 20 | 2 12 23 20 20 | 2 5 23 24 29 |
| 3.21 Write instructions for internal/external controls. . . | 24 24 29 22 21 | 3 9 44 20 16 | 2 18 24 24 22 | 9 6 27 27 20 |

## ENTRY LEVEL PROGRAMMER TASK INVENTORY

| | | FREQUENCY<br>1=Never<br>2=< Month<br>3=Monthly<br>4=Weekly<br>5=Daily | PERFORMANCE<br>1=Very Low<br>2=Low<br>3=Average<br>4=High<br>5=Very High | IMPORTANCE<br>1=Slight<br>2=Some<br>3=Important<br>4=Very<br>5=Critical | FUTURE NEED<br>1=Very Low<br>2=Low<br>3=No Change<br>4=High<br>5=Very High |
|---|---|---|---|---|---|
| 3.00 | CODING (Continued) | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.22 | Write edit routines. . . . . | 8 18 46 34 28 | 1 8 41 53 22 | 2 3 45 45 29 | 4 2 57 36 22 |
| 3.23 | Write check digit checking routines. . . . . | 70 27 22 13 2 | 6 10 34 14 10 | 9 17 33 9 8 | 17 27 47 16 10 |
| 3.24 | Write check point-restart instructions . . . . . | 78 27 17 8 3 | 9 14 23 14 7 | 10 15 29 9 7 | 16 17 58 23 8 |
| 3.25 | Write form test pattern routines . . . . . | 77 27 19 12 3 | 6 11 23 20 1 | 8 10 36 6 3 | 10 20 61 11 4 |
| 3.26 | Use coding sheets. . . . . | 4 8 5 15 104 | 0 4 12 40 57 | 4 9 12 39 56 | 2 9 72 20 11 |
| 3.27 | Other_____ | 1 0 2 1 3 | 0 1 1 1 3 | 1 0 0 3 2 | 0 0 2 2 3 |
| 4.00 | TESTING AND DEBUGGING | | | | |
| 4.01 | Read a program listing . . . . . | 0 2 2 11 131 | 0 1 22 43 51 | 1 2 15 46 73 | 1 1 30 34 40 |
| 4.02 | Desk check a program . . . . . | 0 4 8 35 89 | 1 6 25 46 37 | 2 4 19 53 87 | 1 1 48 40 44 |
| 4.03 | Correct syntax (clerical) errors . . . . . | 1 2 14 27 92 | 0 1 25 39 49 | 2 2 20 43 80 | 2 5 64 26 37 |
| 4.04 | Correct logical errors . . . . . | 0 4 13 37 82 | 0 1 24 42 38 | 1 0 20 30 77 | 1 1 48 33 51 |
| 4.05 | Read a trace . . . . . | 42 43 27 12 9 | 4 15 42 27 10 | 7 22 26 23 12 | 12 11 67 26 11 |
| 4.06 | Read a memory dump . . . . . | 22 23 30 42 18 | 6 10 41 32 10 | 5 13 32 37 20 | 6 7 35 30 26 |
| 4.07 | Read a file dump . . . . . | 9 10 20 53 34 | 2 11 23 31 29 | 2 8 27 51 29 | 4 2 30 46 23 |
| 4.08 | Read a cross-reference listing . . . . . | 26 11 21 30 48 | 2 5 20 46 26 | 2 13 21 44 20 | 4 5 63 20 22 |
| 4.09 | Test program using test data . . . . . | 2 8 19 61 46 | 0 5 21 71 26 | 0 3 22 51 48 | 1 1 49 44 29 |
| 4.10 | Test program using live (user) data. . . . . | 5 13 41 43 25 | 2 3 45 61 22 | 2 4 27 43 47 | 2 2 61 27 22 |
| 4.11 | Edit program for effective use of auxiliary storage. . | 53 27 21 20 13 | 2 15 43 14 11 | 6 20 29 22 11 | 9 11 54 20 19 |
| 4.12 | Recommend corrections or modifications to programs . . | 19 34 25 23 15 | 4 13 30 21 12 | 5 23 46 22 14 | 2 6 63 23 25 |
| 4.13 | Other_____ | 1 0 1 1 1 | 0 0 1 1 1 | 0 0 0 2 1 | 0 0 1 2 1 |
| 5.00 | DOCUMENTATION | | | | |
| 5.01 | Prepare a program documentation manual . . . . . | 37 24 27 14 14 | 6 11 45 24 10 | 0 12 21 20 25 | 5 5 40 44 30 |
| 5.02 | Write computer operator instructions . . . . . | 13 23 26 20 22 | 1 12 44 40 10 | 0 12 40 20 28 | 1 2 21 44 26 |
| 5.03 | Write documentation updates after a program revision . | 14 41 23 21 16 | 1 13 30 44 14 | 2 8 46 41 23 | 2 2 24 48 23 |
| 5.04 | Summarize the controls in program to detect errors . . | 40 20 24 9 14 | 2 12 21 17 30 | 2 24 26 17 25 | 6 14 30 27 21 |
| 5.05 | Summarize calculations used in program . . . . . | 47 24 20 6 11 | 4 10 45 25 7 | 6 12 20 20 20 | 0 15 47 27 14 |
| 5.06 | Other_____ | 2 0 1 1 1 | 0 1 0 2 0 | 0 0 1 1 1 | 0 0 2 0 2 |

## ENTRY LEVEL PROGRAMMER TASK INVENTORY

| | | FREQUENCY<br>1=Never<br>2= <Monthly<br>3=Monthly<br>4=Weekly<br>5=Daily | PERFORMANCE<br>1=Very Low<br>2=Low<br>3=Average<br>4=High<br>5=Very High | IMPORTANCE<br>1=Slight<br>2=Some<br>3=Important<br>4=Very<br>5=Critical | FUTURE NEED<br>1=Very Low<br>2=Low<br>3=No Change<br>4=High<br>5=Very High |
|---|---|---|---|---|---|
| 6.00 | MISCELLANEOUS | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 6.01 | Keypunch program . . . . . | 34 20 22 20 13 | 8 18 21 34 17 | 16 46 23 7 7 | 29 22 20 2 6 |
| 6.02 | Patch computer programs. . . . . | 23 14 21 29 43 | 7 8 43 36 22 | 7 8 22 36 21 | 10 4 53 21 28 |
| 6.03 | Perform program maintenance. . . . . | 5 7 29 42 52 | 1 4 20 30 25 | 1 3 14 53 27 | 3 8 21 30 29 |
| 6.04 | Convert a program to another language. . . . . | 79 10 11 1 1 | 10 15 28 10 6 | 18 20 22 8 2 | 25 26 47 13 7 |
| 6.05 | Operate computer for program tests . . . . . | 29 21 9 29 26 | 11 10 26 21 23 | 16 13 21 20 14 | 26 19 20 19 15 |
| 6.06 | Use job control language (Control Cards) . . . . . | 10 2 6 11 100 | 2 6 26 41 41 | 1 6 27 25 54 | 3 6 42 21 48 |
| 6.07 | Use virtual storage techniques . . . . . | 69 13 13 12 26 | 11 9 23 15 12 | 12 11 27 20 10 | 18 7 20 21 28 |
| 6.08 | Perform number system arithmetic . . . . . | 61 21 10 17 21 | 5 6 20 20 14 | 7 16 27 18 17 | 15 7 64 10 13 |
| 6.09 | Convert numbers between number systems . . . . . | 65 25 10 21 19 | 4 11 26 29 13 | 8 22 20 17 18 | 19 15 54 19 13 |
| 6.10 | Prepare printer carriage tape. . . . . | 76 46 13 9 9 | 16 13 20 11 7 | 19 23 21 6 3 | 20 21 26 8 1 |
| 6.11 | Other_____ | 3 0 0 3 0 | 1 0 0 2 1 | 1 0 1 0 3 | 1 0 2 1 2 |

* * * \

APPENDIX N

EMPLOYER SURVEY RESPONSES BY FREQUENCY COUNT

District One (Eau Claire) and Gateway (Kenosha) Technical Institutes — February, 1976

# ENTRY LEVEL PROGRAMMER TASK INVENTORY

DIRECTIONS: Carefully read each task statement and respond as it would relate to any entry level programmer where you work. In making this response, circle a "1" (Never) under the FREQUENCY column if the task is not performed by entry level programmers and proceed to column (D) FUTURE NEED. If the task is performed by entry level programmers, please complete all four columns.

At the end of each group, list and rate any other tasks which are performed.

| | | A FREQUENCY 1=Never 2=< Monthly 3=Monthly 4=Weekly 5=Daily | B PERFORMANCE 1=Very Low 2=Low 3=Average 4=High 5=Very High | C IMPORTANCE 1=Slight 2=Some 3=Important 4=Very 5=Critical | D FUTURE NEED 1=Very Low 2=Low 3=No Change 4=High 5=Very High |
|---|---|---|---|---|---|
| | | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 1.00 | SYSTEMS ANALYSIS AND DESIGN | | | | |
| 1.01 | Use company system standards | 16 10 3 9 43 | 2 15 36 9 4 | 4 7 33 32 20 | 5 3 35 23 22 |
| 1.02 | Write a detailed description of a problem. | 36 16 13 8 4 | 4 13 37 2 1 | 3 8 34 8 4 | 12 6 36 21 13 |
| 1.03 | Work with users on problem | 16 19 17 15 12 | 8 14 31 8 3 | 6 17 16 18 8 | 4 3 38 19 18 |
| 1.04 | Work with systems analyst on problem | 7 7 5 23 38 | 4 14 35 16 7 | 2 5 25 36 17 | 2 2 29 38 18 |
| 1.05 | Work with other programmers on problem | 5 6 5 27 36 | 0 5 40 34 7 | 1 7 30 35 13 | 0 1 37 29 11 |
| 1.06 | Prepare a system flowchart | 31 27 6 6 7 | 5 3 33 9 2 | 4 13 18 13 8 | 7 9 34 18 6 |
| 1.07 | Prepare a card record layout | 30 26 11 18 6 | 2 6 30 19 6 | 7 12 30 15 9 | 17 9 39 13 4 |
| 1.08 | Prepare a printer spacing form | 13 17 18 24 10 | 1 8 31 25 5 | 1 10 31 30 8 | 5 3 43 16 9 |
| 1.09 | Prepare a tape record layout | 29 30 15 13 4 | 2 5 29 14 3 | 3 6 23 12 9 | 11 3 42 12 6 |
| 1.10 | Prepare a disk record layout | 17 21 18 17 8 | 2 8 32 30 3 | 2 4 36 22 13 | 5 3 36 17 15 |
| 1.11 | Prepare a paper tape record layout | 65 7 3 3 1 | 10 2 9 4 0 | 15 1 8 3 0 | 41 4 21 4 1 |
| 1.12 | Other _____ | 5 3 1 1 4 | 0 2 6 0 1 | 0 2 2 2 3 | 4 0 4 3 3 |
| 2.00 | PROGRAM DESIGN | | | | |
| 2.01 | Use standard flowchart symbols | 10 13 13 20 24 | 4 2 25 27 3 | 4 14 24 24 7 | 6 7 44 15 5 |
| 2.02 | Prepare a general (logic) program flowchart. | 10 18 18 21 13 | 2 10 34 32 2 | 2 8 36 27 9 | 6 4 41 30 6 |
| 2.03 | Prepare a detail program flowchart | 30 21 14 15 10 | 2 7 35 18 0 | 2 9 36 17 10 | 9 7 39 16 5 |
| 2.04 | Prepare a grid chart | 50 19 5 2 1 | 5 8 17 3 0 | 9 14 9 2 0 | 33 9 25 5 0 |
| 2.05 | Prepare a decision table | 43 21 10 6 1 | 6 10 24 4 0 | 9 17 11 7 0 | 15 10 34 13 1 |
| 2.06 | Divide a program into modules. | 27 16 13 16 7 | 6 5 34 8 4 | 8 7 25 14 7 | 0 3 31 33 11 |
| 2.07 | Use structured programming techniques. | 31 9 7 12 22 | 4 8 24 1.. 4 | 3 10 19 13 13 | 7 1 18 31 19 |
| 2.08 | Prepare a test data for programs | 3 8 16 34 21 | 0 8 41 16 10 | 1 6 30 21 27 | 0 1 25 30 33 |

| ENTRY LEVEL PROGRAMMER TASK INVENTORY | FREQUENCY<br>1=Never<br>2=< Monthly<br>3=Monthly<br>4=Weekly<br>5=Daily<br>1 2 3 4 5 | PERFORMANCE<br>1=Very Low<br>2=Low<br>3=Average<br>4=High<br>5=Very High<br>1 2 3 4 5 | IMPORTANCE<br>1=Slight<br>2=Some<br>3=Important<br>4=Very<br>5=Critical<br>1 2 3 4 5 | FUTURE NEED<br>1=Very Low<br>2=Low<br>3=No Change<br>4=High<br>5=Very High<br>1 2 3 4 5 |
|---|---|---|---|---|
| 2.00 PROGRAM DESIGN (Continued) | | | | |
| 2.09 Select appropriate data names for data . . . . . | 13 12 10 14 33 | 3 9 34 18 6 | 4 18 21 17 12 | 1 2 46 14 14 |
| 2.10 Select file organization & access methods for data files | 39 23 6 14 9 | 6 14 13 10 6 | 2 9 16 20 8 | 5 3 37 17 13 |
| 2.11 Select appropriate programming language for problem. . | 56 9 3 4 5 | 6 5 9 7 3 | 6 7 10 8 3 | 14 3 29 3 3 |
| 2.12 Other_____ | 2 2 0 0 1 | 1 2 0 0 1 | 0 1 1 1 1 | 0 1 2 1 1 |
| 3.00 CODING | | | | |
| 3.01 Write assembler language instructions. . . . . | 45 17 4 3 11 | 9 8 17 9 2 | 11 13 9 3 9 | 30 9 20 9 6 |
| 3.02 Write higher level language instructions . . . . . | 10 3 4 6 51 | 2 6 30 20 8 | 2 3 14 23 31 | 2 1 26 25 19 |
| 3.03 Write report program generator language instructions . | 30 20 3 3 14 | 3 9 21 8 4 | 7 13 12 6 10 | 12 6 25 8 9 |
| 3.04 Use tape sort utility routines . . . . . | 31 10 16 12 13 | 3 5 31 10 4 | 5 5 30 9 4 | 13 3 49 5 4 |
| 3.05 Use disk sort utility routines . . . . . | 5 6 18 23 27 | 0 7 42 17 10 | 2 5 41 17 11 | 2 0 35 11 16 |
| 3.06 Write table building instructions. . . . . | 9 21 22 13 16 | 0 10 40 10 4 | 2 9 32 22 7 | 1 2 46 23 4 |
| 3.07 Write table searching instructions . . . . . | 8 16 25 15 17 | 0 8 42 19 5 | 1 7 33 25 7 | 1 1 46 23 5 |
| 3.08 Write table sorting instructions . . . . . | 31 23 15 6 6 | 2 14 36 9 2 | 5 13 30 12 1 | 9 4 46 12 2 |
| 3.09 Write sequential disk file handling routines . . . . . | 12 7 21 18 23 | 1 5 32 27 5 | 3 5 28 24 10 | 2 2 50 17 4 |
| 3.10 Use index-sequential disk file handling routines . . . | 11 14 19 15 22 | 2 11 30 21 6 | 2 5 27 28 8 | 1 5 43 17 9 |
| 3.11 Use random disk file handling routines . . . . . | 19 24 15 12 11 | 2 10 27 13 5 | 3 9 29 16 7 | 1 4 44 17 9 |
| 3.12 Use tape file handling routines. . . . . | 17 6 19 22 17 | 1 4 32 22 6 | 2 4 32 22 5 | 7 4 51 13 3 |
| 3.13 Use card file handling routines. . . . . | 13 12 15 18 23 | 1 4 36 24 4 | 3 6 32 22 6 | 6 12 53 7 0 |
| 3.14 Use data communications routines . . . . . | 36 23 9 3 10 | 9 12 21 4 2 | 4 10 18 18 6 | 1 4 19 30 18 |
| 3.15 Write subroutines. . . . . | 15 17 18 17 14 | 1 14 32 13 4 | 2 7 26 26 5 | 3 34 28 10 |
| 3.16 Write error routines . . . . . | 9 3 26 24 19 | 1 5 41 29 3 | 1 3 27 35 5 | 1 1 29 27 6 |
| 3.17 Use library routines . . . . . | 10 9 17 17 28 | 0 8 37 26 7 | 3 9 29 19 11 | 2 3 40 29 13 |
| 3.18 Write library routines . . . . . | 30 26 5 6 7 | 6 16 15 3 5 | 4 17 15 7 3 | 7 6 36 17 6 |
| 3.19 Use macros . . . . . | 31 18 12 3 15 | 4 12 31 11 3 | 6 13 14 15 6 | 9 6 26 26 5 |
| 3.20 Write comments in program. . . . . | 3 4 12 26 46 | 3 6 33 27 9 | 1 7 22 24 35 | 8 8 43 17 10 |
| 3.21 Write instructions for internal/external controls. . . | 19 13 21 11 16 | 6 13 33 7 4 | 4 6 31 [illegible] 8 | 4 28 30 21 6 |

| ENTRY LEVEL PROGRAMMER TASK INVENTORY | FREQUENCY<br>1=Never<br>2=< Monthly<br>3=Monthly<br>4=Weekly<br>5=Daily | PERFORMANCE<br>1=Very Low<br>2=Low<br>3=Average<br>4=High<br>5=Very High | IMPORTANCE<br>1=Slight<br>2=Some<br>3=Important<br>4=Vary<br>5=Critical | FUTURE NEED<br>1=Very Low<br>2=Low<br>3=No Change<br>4=High<br>5=Very High |
|---|---|---|---|---|
| | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 3.00 CODING (Continued) | | | | |
| 3.22 Write edit routines. . . . . | 1 13 21 24 33 | 0 6 45 33 6 | 1 4 29 36 10 | 0 0 47 33 10 |
| 3.23 Write check digit checking routines. . . . . | 65 25 3 4 4 | 4 13 31 4 0 | 5 16 14 5 1 | 11 13 37 9 1 |
| 3.24 Write check point-restart instructions . . . . . | 68 21 7 4 1 | 8 12 15 5 0 | 5 17 9 7 7 | 9 9 31 13 6 |
| 3.25 Write form test pattern routines . . . . . | 81 23 3 1 3 | 6 10 14 3 2 | 9 32 9 4 1 | 16 8 37 0 1 |
| 3.26 Use coding sheets. . . . . | 1 1 3 8 67 | 0 6 34 29 24 | 1 4 37 15 30 | 1 5 53 0 11 |
| 3.27 Other_____ | 1 0 1 0 1 | 0 0 1 2 0 | 0 0 3 0 1 | 0 0 4 0 0 |
| 4.00 TESTING AND DEBUGGING | | | | |
| 4.01 Read a program listing . . . . . | 0 0 1 4 76 | 0 3 25 36 17 | 0 1 13 30 39 | 0 0 43 13 32 |
| 4.02 Desk check a program . . . . . | 0 0 0 15 66 | 3 5 27 30 16 | 0 3 13 30 38 | 0 0 30 19 33 |
| 4.03 Correct syntax (clerical) errors . . . . . | 1 0 3 17 60 | 0 2 25 39 14 | 1 3 17 29 33 | 3 0 46 15 17 |
| 4.04 Correct logical errors . . . . . | 0 1 4 20 56 | 1 6 35 27 12 | 0 1 14 32 34 | 0 0 30 19 31 |
| 4.05 Read a trace . . . . . | 18 19 30 14 10 | 6 11 38 13 3 | 4 13 29 14 7 | 6 6 46 13 5 |
| 4.06 Read a memory dump . . . . . | 13 10 11 28 17 | 7 14 31 15 3 | 3 10 36 18 13 | 9 8 38 10 7 |
| 4.07 Read a file dump . . . . . | 4 6 18 36 27 | 3 6 40 33 6 | 1 5 28 31 17 | 1 0 47 33 9 |
| 4.08 Read a cross-reference listing . . . . . | 13 7 11 19 32 | 3 6 31 36 7 | 3 7 31 29 13 | 3 3 50 14 0 |
| 4.09 Test program using test data . . . . . | 0 1 8 28 44 | 0 4 36 25 15 | 1 0 25 32 32 | 0 0 40 30 30 |
| 4.10 Test program using live (user) data. . . . . | 4 7 18 28 23 | 1 10 35 18 13 | 3 1 23 30 30 | 1 3 30 30 16 |
| 4.11 Edit program for effective use of auxiliary storage. . | 28 24 15 6 7 | 5 19 20 9 3 | 3 13 19 30 6 | 5 6 43 10 7 |
| 4.12 Recommend corrections or modifications to programs . . | 8 13 23 21 16 | 3 15 30 9 7 | 3 11 36 15 9 | 1 8 46 19 10 |
| 4.13 Other_____ | 1 0 1 0 0 | 0 0 1 0 0 | 0 0 1 0 0 | 0 1 4 0 0 |
| 5.00 DOCUMENTATION | | | | |
| 5.01 Prepare a program documentation manual . . . . . | 18 19 18 15 11 | 5 13 30 15 4 | 3 3 29 34 8 | 3 2 32 34 17 |
| 5.02 Write computer operator instructions . . . . . | 6 13 24 18 21 | 4 12 37 15 7 | 3 4 20 34 34 | 1 4 30 22 13 |
| 5.03 Write documentation updates after a program revision . | 6 17 17 25 16 | 4 14 30 13 7 | 3 3 32 34 13 | 1 3 37 34 15 |
| 5.04 Summarize the controls in program to detect errors . . | 15 20 24 13 9 | 4 12 34 13 3 | 3 16 28 19 7 | 3 4 35 37 9 |
| 5.05 Summarize calculations used in program . . . . . | 20 20 20 11 10 | 3 11 37 9 3 | 3 8 37 30 5 | 5 4 37 33 0 |
| 5.06 Other_____ | 1 0 1 0 0 | 0 0 0 0 0 | 0 0 0 0 0 | 0 0 4 1 0 |

| ENTRY LEVEL PROGRAMMER TASK INVENTORY | FREQUENCY<br>1=Never<br>2= <Monthly<br>3=Monthly<br>4=Weekly<br>5=Daily | PERFORMANCE<br>1=Very Low<br>2=Low<br>3=Average<br>4=High<br>5=Very High | IMPORTANCE<br>1=Slight<br>2=Some<br>3=Important<br>4=Very<br>5=Critical | FUTURE NEED<br>1=Very Low<br>2=Low<br>3=No Change<br>4=High<br>5=Very High |
|---|---|---|---|---|
| 6.00 MISCELLANEOUS | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 3 4 5 |
| 6.01 Keypunch program | 19 24 11 19 8 | 5 9 25 22 7 | 17 26 19 5 1 | 18 16 43 4 0 |
| 6.02 Patch computer programs | 31 11 12 10 16 | 5 2 30 12 6 | 5 10 21 11 8 | 13 5 39 9 9 |
| 6.03 Perform program maintenance | 1 6 18 24 32 | 0 6 43 23 8 | 1 4 27 30 18 | 0 1 43 24 12 |
| 6.04 Convert a program to another language | 52 25 3 0 2 | 9 4 19 5 1 | 18 11 14 4 0 | 32 7 31 7 2 |
| 6.05 Operate computer for program tests | 31 10 7 13 20 | 8 7 20 13 10 | 9 13 19 12 6 | 13 13 40 10 2 |
| 6.06 Use job control language (Control Cards) | 8 1 2 12 58 | 2 6 30 20 14 | 3 3 24 20 23 | 3 3 36 20 16 |
| 6.07 Use virtual storage techniques | 41 3 12 12 12 | 7 6 22 7 3 | 5 5 26 7 3 | 14 1 33 15 11 |
| 6.08 Perform number system arithmetic | 27 14 5 17 18 | 4 7 27 15 4 | 7 9 23 15 4 | 12 2 50 6 3 |
| 6.09 Convert numbers between number systems | 29 17 9 10 16 | 5 7 24 15 5 | 8 8 16 20 4 | 13 6 44 7 3 |
| 6.10 Prepare printer carriage tape | 42 34 2 2 1 | 9 10 24 2 2 | 9 21 16 1 1 | 17 12 41 3 2 |
| 6.11 Other _____ | 1 0 0 0 1 | 0 1 0 0 0 | 0 0 0 1 0 | 0 0 1 1 0 |

NOTE: Section 7.00--GENERAL EDUCATION AND LEARNING EXPERIENCES was not filled out by the Employer/Supervisor group.

APPENDIX O

RANKS, MEAN, STANDARD ERROR OF THE MEAN, STANDARD DEVIATION, STANDARD ERROR OF THE STANDARD DEVIATION, AND RANK DIFFERENCE FOR ALL TASKS BY ITEM NUMBER

FREQUENCY

| ITEM NO. | GRADUATE ITEM RANK | GRADUATE MEAN | GRADUATE S.E. MEAN | GRADUATE S.D. | GRADUATE S.E. S.D. | EMPLOYER ITEM RANK | EMPLOYER MEAN | EMPLOYER S.E. MEAN | EMPLOYER S.D. | EMPLOYER S.E. S.D. | RANK DIFF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 08.0 | 4.10 | 0.11 | 1.26 | 0.08 | 17.5 | 3.65 | 0.18 | 1.65 | 0.13 | 09.5 |
| 1.02 | 51.0 | 2.40 | 0.11 | 1.27 | 0.08 | 64.0 | 2.04 | 0.13 | 1.21 | 0.10 | 13.0 |
| 1.03 | 37.0 | 2.98 | 0.12 | 1.36 | 0.08 | 40.0 | 2.80 | 0.15 | 1.36 | 0.11 | 03.0 |
| 1.04 | 19.0 | 3.53 | 0.12 | 1.37 | 0.08 | 10.5 | 3.99 | 0.14 | 1.29 | 0.10 | 08.5 |
| 1.05 | 07.0 | 4.13 | 0.09 | 1.07 | 0.06 | 09.0 | 4.07 | 0.13 | 1.17 | 0.09 | 02.0 |
| 1.06 | 55.0 | 2.30 | 0.10 | 1.12 | 0.07 | 61.0 | 2.17 | 0.14 | 1.27 | 0.10 | 06.0 |
| 1.07 | 49.0 | 2.49 | 0.09 | 1.08 | 0.07 | 52.0 | 2.58 | 0.15 | 1.31 | 0.10 | 03.0 |
| 1.08 | 34.0 | 3.06 | 0.09 | 1.08 | 0.07 | 35.0 | 3.04 | 0.14 | 1.26 | 0.10 | 01.0 |
| 1.09 | 57.5 | 2.27 | 0.10 | 1.17 | 0.07 | 58.0 | 2.28 | 0.14 | 1.23 | 0.10 | 00.5 |
| 1.10 | 45.0 | 2.59 | 0.10 | 1.20 | 0.07 | 45.0 | 2.73 | 0.14 | 1.28 | 0.10 | 00.0 |
| 1.11 | 75.0 | 1.12 | 0.04 | 0.43 | 0.03 | 75.0 | 1.33 | 0.09 | 0.82 | 0.07 | 00.0 |
| 2.01 | 25.0 | 3.26 | 0.10 | 1.22 | 0.07 | 23.5 | 3.44 | 0.15 | 1.39 | 0.11 | 01.5 |
| 2.02 | 35.5 | 3.01 | 0.09 | 1.10 | 0.07 | 33.0 | 3.11 | 0.14 | 1.27 | 0.10 | 02.5 |
| 2.03 | 50.0 | 2.47 | 0.10 | 1.20 | 0.07 | 46.0 | 2.68 | 0.15 | 1.36 | 0.11 | 04.0 |
| 2.04 | 74.0 | 1.23 | 0.05 | 0.55 | 0.03 | 72.0 | 1.51 | 0.09 | 0.83 | 0.07 | 02.0 |
| 2.05 | 73.0 | 1.52 | 0.07 | 0.83 | 0.05 | 67.0 | 1.79 | 0.11 | 1.01 | 0.08 | 06.0 |
| 2.06 | 59.5 | 2.26 | 0.10 | 1.17 | 0.07 | 54.0 | 2.53 | 0.15 | 1.37 | 0.11 | 05.5 |
| 2.07 | 26.0 | 3.22 | 0.13 | 1.51 | 0.09 | 38.5 | 2.81 | 0.19 | 1.69 | 0.13 | 12.5 |
| 2.08 | 18.0 | 3.55 | 0.09 | 1.11 | 0.07 | 13.5 | 3.81 | 0.11 | 1.03 | 0.08 | 04.5 |
| 2.09 | 09.0 | 4.05 | 0.10 | 1.11 | 0.07 | 22.0 | 3.49 | 0.17 | 1.52 | 0.12 | 13.0 |
| 2.10 | 47.0 | 2.55 | 0.12 | 1.34 | 0.08 | 56.0 | 2.40 | 0.16 | 1.40 | 0.11 | 09.0 |
| 2.11 | 68.0 | 1.78 | 0.11 | 1.28 | 0.08 | 69.0 | 1.65 | 0.13 | 1.19 | 0.09 | 01.0 |
| 3.01 | 65.0 | 1.95 | 0.12 | 1.43 | 0.09 | 65.0 | 1.98 | 0.16 | 1.41 | 0.11 | 00.0 |
| 3.02 | 13.0 | 3.86 | 0.13 | 1.53 | 0.09 | 12.0 | 3.91 | 0.18 | 1.62 | 0.13 | 01.0 |
| 3.03 | 63.0 | 2.06 | 0.14 | 1.58 | 0.10 | 61.0 | 2.17 | 0.17 | 1.49 | 0.12 | 02.0 |
| 3.04 | 59.5 | 2.26 | 0.12 | 1.38 | 0.08 | 53.0 | 2.56 | 0.16 | 1.48 | 0.12 | 06.5 |
| 3.05 | 23.0 | 3.34 | 0.11 | 1.29 | 0.08 | 16.0 | 3.73 | 0.13 | 1.20 | 0.09 | 07.0 |
| 3.06 | 30.0 | 3.13 | 0.10 | 1.18 | 0.07 | 34.0 | 3.07 | 0.14 | 1.28 | 0.10 | 04.0 |
| 3.07 | 28.0 | 3.17 | 0.10 | 1.15 | 0.07 | 31.0 | 3.21 | 0.14 | 1.25 | 0.10 | 03.0 |
| 3.08 | 64.0 | 1.99 | 0.10 | 1.13 | 0.07 | 61.0 | 2.17 | 0.14 | 1.23 | 0.10 | 03.0 |
| 3.09 | 20.0 | 3.50 | 0.11 | 1.26 | 0.08 | 25.0 | 3.41 | 0.15 | 1.37 | 0.11 | 05.0 |
| 3.10 | 33.0 | 3.07 | 0.11 | 1.32 | 0.08 | 29.0 | 3.29 | 0.16 | 1.39 | 0.11 | 04.0 |
| 3.11 | 43.0 | 2.63 | 0.12 | 1.34 | 0.08 | 48.0 | 2.65 | 0.15 | 1.34 | 0.11 | 05.0 |
| 3.12 | 29.0 | 3.16 | 0.13 | 1.48 | 0.09 | 32.0 | 3.20 | 0.16 | 1.41 | 0.11 | 03.0 |
| 3.13 | 24.0 | 3.33 | 0.11 | 1.29 | 0.08 | 27.0 | 3.32 | 0.16 | 1.43 | 0.11 | 03.0 |
| 3.14 | 56.0 | 2.28 | 0.13 | 1.42 | 0.09 | 63.0 | 2.11 | 0.15 | 1.34 | 0.11 | 07.0 |
| 3.15 | 40.0 | 2.91 | 0.12 | 1.42 | 0.09 | 36.0 | 2.98 | 0.15 | 1.36 | 0.11 | 04.0 |
| 3.16 | 17.0 | 3.64 | 0.10 | 1.18 | 0.07 | 21.0 | 3.51 | 0.13 | 1.21 | 0.09 | 04.0 |
| 3.17 | 27.0 | 3.19 | 0.13 | 1.47 | 0.09 | 20.0 | 3.54 | 0.15 | 1.38 | 0.11 | 07.0 |
| 3.18 | 67.0 | 1.83 | 0.10 | 1.14 | 0.07 | 66.0 | 1.95 | 0.14 | 1.23 | 0.10 | 01.0 |
| 3.19 | 52.0 | 2.37 | 0.13 | 1.49 | 0.09 | 55.0 | 2.41 | 0.17 | 1.50 | 0.12 | 03.0 |
| 3.20 | 12.0 | 3.94 | 0.10 | 1.20 | 0.07 | 08.0 | 4.16 | 0.12 | 1.08 | 0.09 | 04.0 |
| 3.21 | 42.0 | 2.76 | 0.12 | 1.42 | 0.09 | 37.0 | 2.87 | 0.16 | 1.42 | 0.11 | 05.0 |
| 3.22 | 21.5 | 3.42 | 0.10 | 1.13 | 0.07 | 17.5 | 3.65 | 0.12 | 1.08 | 0.08 | 04.0 |
| 3.23 | 66.0 | 1.88 | 0.09 | 1.09 | 0.07 | 68.0 | 1.73 | 0.12 | 1.08 | 0.08 | 02.0 |
| 3.24 | 69.0 | 1.73 | 0.09 | 1.04 | 0.06 | 70.0 | 1.63 | 0.10 | 0.92 | 0.07 | 01.0 |
| 3.25 | 70.0 | 1.70 | 0.09 | 1.05 | 0.07 | 73.0 | 1.50 | 0.09 | 0.84 | 0.07 | 03.0 |
| 3.26 | 03.5 | 4.52 | 0.09 | 1.01 | 0.06 | 03.0 | 4.74 | 0.08 | 0.70 | 0.06 | 00.5 |
| 4.01 | 01.0 | 4.85 | 0.04 | 0.50 | 0.03 | 01.0 | 4.93 | 0.03 | 0.31 | 0.02 | 00.0 |
| 4.02 | 02.0 | 4.54 | 0.06 | 0.74 | 0.04 | 02.0 | 4.81 | 0.04 | 0.39 | 0.03 | 00.0 |
| 4.03 | 03.5 | 4.52 | 0.07 | 0.79 | 0.05 | 04.0 | 4.67 | 0.07 | 0.67 | 0.05 | 00.5 |
| 4.04 | 06.0 | 4.45 | 0.07 | 0.78 | 0.05 | 05.0 | 4.62 | 0.07 | 0.64 | 0.05 | 01.0 |
| 4.05 | 57.5 | 2.27 | 0.10 | 1.19 | 0.07 | 44.0 | 2.74 | 0.15 | 1.31 | 0.10 | 13.5 |
| 4.06 | 32.0 | 3.08 | 0.11 | 1.29 | 0.08 | 30.0 | 3.27 | 0.16 | 1.41 | 0.11 | 02.0 |
| 4.07 | 14.5 | 3.68 | 0.10 | 1.12 | 0.07 | 13.5 | 3.81 | 0.12 | 1.12 | 0.09 | 01.0 |
| 4.08 | 14.5 | 3.68 | 0.12 | 1.35 | 0.08 | 19.0 | 3.64 | 0.16 | 1.44 | 0.11 | 04.5 |
| 4.09 | 10.0 | 4.04 | 0.08 | 0.92 | 0.06 | 06.0 | 4.42 | 0.08 | 0.72 | 0.06 | 04.0 |
| 4.10 | 16.0 | 3.65 | 0.09 | 1.07 | 0.07 | 15.0 | 3.74 | 0.12 | 1.12 | 0.09 | 01.0 |
| 4.11 | 62.0 | 2.20 | 0.11 | 1.30 | 0.08 | 59.0 | 2.25 | 0.14 | 1.25 | 0.10 | 03.0 |
| 4.12 | 39.0 | 2.93 | 0.10 | 1.22 | 0.07 | 28.0 | 3.30 | 0.14 | 1.23 | 0.10 | 11.0 |
| 5.01 | 48.0 | 2.51 | 0.11 | 1.27 | 0.08 | 41.0 | 2.78 | 0.15 | 1.34 | 0.11 | 07.0 |
| 5.02 | 31.0 | 3.11 | 0.10 | 1.22 | 0.07 | 23.5 | 3.44 | 0.14 | 1.23 | 0.10 | 07.5 |
| 5.03 | 38.0 | 2.96 | 0.10 | 1.19 | 0.07 | 26.0 | 3.35 | 0.14 | 1.22 | 0.10 | 12.0 |
| 5.04 | 53.5 | 2.34 | 0.11 | 1.30 | 0.08 | 42.5 | 2.77 | 0.14 | 1.24 | 0.10 | 11.0 |
| 5.05 | 61.0 | 2.25 | 0.11 | 1.22 | 0.07 | 49.0 | 2.64 | 0.15 | 1.32 | 0.10 | 12.0 |
| 6.01 | 44.0 | 2.61 | 0.11 | 1.31 | 0.08 | 47.0 | 2.67 | 0.15 | 1.32 | 0.10 | 03.0 |
| 6.02 | 21.5 | 3.42 | 0.13 | 1.48 | 0.09 | 50.0 | 2.61 | 0.18 | 1.57 | 0.12 | 28.5 |
| 6.03 | 11.0 | 3.96 | 0.09 | 1.07 | 0.06 | 10.5 | 3.99 | 0.11 | 1.01 | 0.08 | 00.5 |
| 6.04 | 71.0 | 1.56 | 0.07 | 0.83 | 0.05 | 74.0 | 1.46 | 0.09 | 0.79 | 0.06 | 03.0 |
| 6.05 | 35.5 | 3.01 | 0.14 | 1.62 | 0.10 | 42.5 | 2.77 | 0.18 | 1.66 | 0.13 | 07.0 |
| 6.06 | 05.0 | 4.49 | 0.10 | 1.15 | 0.07 | 07.0 | 4.37 | 0.14 | 1.24 | 0.10 | 02.0 |
| 6.07 | 53.5 | 2.34 | 0.14 | 1.63 | 0.10 | 57.0 | 2.39 | 0.18 | 1.57 | 0.12 | 03.5 |
| 6.08 | 41.0 | 2.81 | 0.14 | 1.58 | 0.10 | 38.5 | 2.81 | 0.18 | 1.60 | 0.13 | 02.5 |
| 6.09 | 46.0 | 2.56 | 0.13 | 1.47 | 0.09 | 51.0 | 2.59 | 0.17 | 1.55 | 0.12 | 05.0 |
| 6.10 | 72.0 | 1.53 | 0.06 | 0.66 | 0.04 | 71.0 | 1.59 | 0.09 | 0.77 | 0.06 | 01.0 |



MEAN RANK DIFFERENCE IS 4.6

PERFORMANCE

| ITEM NO. | GRADUATE ITEM RANK | GRADUATE MEAN | GRADUATE S.E. MEAN | GRADUATE S.D. | GRADUATE S.E. S.D. | EMPLOYER ITEM RANK | EMPLOYER MEAN | EMPLOYER S.E. MEAN | EMPLOYER S.D. | EMPLOYER S.E. S.D. | RANK DIFF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 46.0 | 3.34 | 0.07 | 0.80 | 0.05 | 51.0 | 2.97 | 0.10 | 0.85 | 0.07 | 05.0 |
| 1.02 | 69.0 | 2.96 | 0.09 | 0.88 | 0.06 | 66.0 | 2.64 | 0.11 | 0.78 | 0.08 | 03.0 |
| 1.03 | 52.0 | 3.26 | 0.09 | 0.92 | 0.06 | 63.0 | 2.75 | 0.12 | 0.98 | 0.09 | 11.0 |
| 1.04 | 44.5 | 3.37 | 0.08 | 0.89 | 0.06 | 40.5 | 3.11 | 0.11 | 0.98 | 0.08 | 04.0 |
| 1.05 | 19.5 | 3.71 | 0.07 | 0.81 | 0.05 | 09.0 | 3.43 | 0.09 | 0.75 | 0.06 | 10.5 |
| 1.06 | 57.5 | 3.21 | 0.10 | 1.06 | 0.07 | 47.0 | 3.00 | 0.12 | 0.88 | 0.09 | 10.5 |
| 1.07 | 31.0 | 3.57 | 0.09 | 0.98 | 0.06 | 21.0 | 3.33 | 0.11 | 0.89 | 0.08 | 10.0 |
| 1.08 | 19.5 | 3.71 | 0.08 | 0.86 | 0.05 | 19.5 | 3.36 | 0.10 | 0.83 | 0.07 | 00.0 |
| 1.09 | 37.0 | 3.49 | 0.10 | 0.96 | 0.07 | 33.0 | 3.24 | 0.11 | 0.83 | 0.08 | 04.0 |
| 1.10 | 26.0 | 3.64 | 0.09 | 0.97 | 0.07 | 31.0 | 3.22 | 0.10 | 0.83 | 0.07 | 05.0 |
| 1.11 | 75.0 | 2.05 | 0.20 | 1.21 | 0.14 | 75.0 | 2.28 | 0.23 | 1.35 | 0.16 | 00.0 |
| 2.01 | 24.0 | 3.66 | 0.08 | 0.88 | 0.06 | 27.0 | 3.32 | 0.10 | 0.84 | 0.07 | 01.0 |
| 2.02 | 24.0 | 3.66 | 0.08 | 0.87 | 0.05 | 34.5 | 3.17 | 0.10 | 0.81 | 0.07 | 10.5 |
| 2.03 | 31.0 | 3.57 | 0.09 | 0.90 | 0.06 | 42.0 | 3.08 | 0.10 | 0.76 | 0.07 | 11.0 |
| 2.04 | 74.0 | 2.33 | 0.15 | 0.97 | 0.11 | 71.0 | 2.55 | 0.13 | 0.86 | 0.11 | 03.0 |
| 2.05 | 71.0 | 2.81 | 0.13 | 0.98 | 0.09 | 69.0 | 2.59 | 0.13 | 0.83 | 0.09 | 02.0 |
| 2.06 | 59.0 | 3.19 | 0.09 | 0.90 | 0.07 | 49.5 | 2.98 | 0.13 | 0.96 | 0.09 | 09.5 |
| 2.07 | 35.0 | 3.51 | 0.09 | 0.94 | 0.06 | 54.0 | 3.06 | 0.14 | 1.00 | 0.10 | 09.0 |
| 2.08 | 21.5 | 3.70 | 0.07 | 0.84 | 0.05 | 16.0 | 3.39 | 0.10 | 0.84 | 0.07 | 05.5 |
| 2.09 | 10.0 | 3.85 | 0.07 | 0.80 | 0.05 | 27.0 | 3.26 | 0.11 | 0.96 | 0.08 | 17.0 |
| 2.10 | 57.5 | 3.21 | 0.10 | 0.99 | 0.07 | 55.0 | 2.93 | 0.15 | 1.14 | 0.11 | 02.5 |
| 2.11 | 48.0 | 3.32 | 0.16 | 1.23 | 0.12 | 60.0 | 2.84 | 0.22 | 1.25 | 0.16 | 12.0 |
| 3.01 | 65.0 | 3.00 | 0.47 | 0.82 | 0.33 | 64.0 | 2.71 | 0.17 | 1.13 | 0.12 | 01.0 |
| 3.02 | 12.0 | 3.13 | 0.14 | 1.17 | 0.10 | 16.0 | 3.39 | 0.11 | 0.92 | 0.08 | 04.0 |
| 3.03 | 66.0 | 3.77 | 0.09 | 0.94 | 0.06 | 53.0 | 2.94 | 0.15 | 1.06 | 0.11 | 13.0 |
| 3.04 | 42.0 | 3.12 | 0.14 | 1.16 | 0.10 | 38.0 | 3.13 | 0.12 | 0.89 | 0.09 | 04.0 |
| 3.05 | 14.0 | 3.41 | 0.11 | 1.01 | 0.08 | 16.0 | 3.39 | 0.10 | 0.83 | 0.07 | 02.0 |
| 3.06 | 29.0 | 3.76 | 0.08 | 0.86 | 0.06 | 31.0 | 3.22 | 0.09 | 0.75 | 0.06 | 02.0 |
| 3.07 | 27.5 | 3.60 | 0.08 | 0.85 | 0.05 | 25.0 | 3.27 | 0.09 | 0.75 | 0.06 | 02.5 |
| 3.08 | 61.5 | 3.61 | 0.08 | 0.85 | 0.05 | 56.0 | 2.91 | 0.12 | 0.85 | 0.08 | 05.5 |
| 3.09 | 14.0 | 3.17 | 0.11 | 0.99 | 0.08 | 09.0 | 3.43 | 0.09 | 0.79 | 0.07 | 05.0 |
| 3.10 | 34.0 | 3.76 | 0.07 | 0.80 | 0.05 | 27.0 | 3.26 | 0.11 | 0.92 | 0.08 | 07.0 |
| 3.11 | 44.5 | 3.54 | 0.08 | 0.89 | 0.06 | 47.0 | 3.00 | 0.12 | 0.95 | 0.08 | 02.5 |
| 3.12 | 24.0 | 3.37 | 0.09 | 0.94 | 0.07 | 09.0 | 3.43 | 0.10 | 0.80 | 0.07 | 15.0 |
| 3.13 | 14.0 | 3.76 | 0.08 | 0.87 | 0.06 | 18.0 | 3.37 | 0.09 | 0.74 | 0.06 | 04.0 |
| 3.14 | 55.0 | 3.23 | 0.12 | 1.06 | 0.08 | 72.5 | 2.53 | 0.14 | 1.01 | 0.10 | 17.5 |
| 3.15 | 33.0 | 3.55 | 0.10 | 0.98 | 0.07 | 40.5 | 3.11 | 0.11 | 0.86 | 0.07 | 07.5 |
| 3.16 | 11.0 | 3.78 | 0.07 | 0.80 | 0.05 | 27.0 | 3.26 | 0.08 | 0.71 | 0.06 | 16.0 |
| 3.17 | 27.5 | 3.61 | 0.09 | 0.94 | 0.06 | 23.0 | 3.32 | 0.10 | 0.81 | 0.07 | 04.5 |
| 3.18 | 67.0 | 3.07 | 0.12 | 1.00 | 0.09 | 65.0 | 2.67 | 0.17 | 1.14 | 0.12 | 02.0 |
| 3.19 | 60.0 | 3.18 | 0.13 | 1.16 | 0.09 | 53.0 | 2.94 | 0.14 | 1.00 | 0.10 | 07.0 |
| 3.20 | 06.0 | 3.92 | 0.08 | 0.91 | 0.06 | 12.0 | 3.42 | 0.10 | 0.93 | 0.07 | 06.0 |
| 3.21 | 41.0 | 3.44 | 0.09 | 0.92 | 0.07 | 60.0 | 2.84 | 0.12 | 0.96 | 0.09 | 19.0 |
| 3.22 | 21.5 | 3.70 | 0.08 | 0.86 | 0.05 | 19.5 | 3.36 | 0.08 | 0.73 | 0.06 | 02.0 |
| 3.23 | 63.5 | 3.16 | 0.13 | 1.08 | 0.09 | 68.0 | 2.60 | 0.12 | 0.79 | 0.09 | 04.5 |
| 3.24 | 70.0 | 2.94 | 0.14 | 1.17 | 0.10 | 74.0 | 2.43 | 0.15 | 0.95 | 0.11 | 04.0 |
| 3.25 | 68.0 | 2.98 | 0.13 | 0.99 | 0.09 | 70.0 | 2.57 | 0.18 | 1.05 | 0.13 | 02.0 |
| 3.26 | 01.0 | 4.21 | 0.07 | 0.83 | 0.05 | 01.0 | 4.00 | 0.09 | 0.79 | 0.06 | 00.0 |
| 4.01 | 02.0 | 4.20 | 0.06 | 0.73 | 0.04 | 02.0 | 3.83 | 0.09 | 0.80 | 0.06 | 00.0 |
| 4.02 | 05.0 | 3.98 | 0.07 | 0.84 | 0.05 | 05.0 | 3.63 | 0.11 | 0.99 | 0.08 | 00.0 |
| 4.03 | 03.0 | 4.16 | 0.06 | 0.75 | 0.05 | 03.0 | 3.81 | 0.08 | 0.74 | 0.06 | 00.0 |
| 4.04 | 04.0 | 4.01 | 0.06 | 0.75 | 0.05 | 06.5 | 3.53 | 0.10 | 0.88 | 0.07 | 02.5 |
| 4.05 | 53.0 | 3.24 | 0.10 | 0.97 | 0.07 | 57.0 | 2.89 | 0.11 | 0.91 | 0.08 | 04.0 |
| 4.06 | 47.0 | 3.33 | 0.10 | 1.08 | 0.07 | 58.0 | 2.87 | 0.12 | 0.96 | 0.08 | 11.0 |
| 4.07 | 17.5 | 3.72 | 0.09 | 0.99 | 0.06 | 23.0 | 3.32 | 0.10 | 0.83 | 0.07 | 05.5 |
| 4.08 | 08.5 | 3.89 | 0.09 | 0.96 | 0.06 | 12.0 | 3.42 | 0.10 | 0.88 | 0.07 | 03.5 |
| 4.09 | 08.5 | 3.89 | 0.07 | 0.75 | 0.05 | 04.0 | 3.64 | 0.09 | 0.84 | 0.07 | 04.5 |
| 4.10 | 16.0 | 3.74 | 0.07 | 0.81 | 0.05 | 12.0 | 3.42 | 0.11 | 0.96 | 0.08 | 04.0 |
| 4.11 | 61.5 | 3.17 | 0.11 | 0.98 | 0.07 | 62.0 | 2.76 | 0.14 | 1.01 | 0.10 | 00.5 |
| 4.12 | 50.5 | 3.29 | 0.08 | 0.91 | 0.06 | 45.0 | 3.03 | 0.11 | 0.94 | 0.08 | 05.5 |
| 5.01 | 50.5 | 3.29 | 0.09 | 0.97 | 0.07 | 47.0 | 3.00 | 0.12 | 0.98 | 0.08 | 03.5 |
| 5.02 | 31.0 | 3.57 | 0.08 | 0.88 | 0.06 | 39.0 | 3.12 | 0.11 | 0.97 | 0.08 | 08.0 |
| 5.03 | 38.0 | 3.47 | 0.08 | 0.86 | 0.06 | 43.0 | 3.07 | 0.11 | 0.96 | 0.08 | 05.0 |
| 5.04 | 55.0 | 3.23 | 0.09 | 0.89 | 0.07 | 49.5 | 2.98 | 0.11 | 0.90 | 0.08 | 05.5 |
| 5.05 | 55.0 | 3.23 | 0.09 | 0.90 | 0.07 | 53.0 | 2.94 | 0.10 | 0.80 | 0.07 | 02.0 |
| 6.01 | 49.0 | 3.31 | 0.11 | 1.14 | 0.08 | 29.0 | 3.25 | 0.13 | 1.05 | 0.09 | 20.0 |
| 6.02 | 36.0 | 3.50 | 0.10 | 1.07 | 0.07 | 31.0 | 3.22 | 0.14 | 1.00 | 0.10 | 05.0 |
| 6.03 | 17.5 | 3.72 | 0.07 | 0.83 | 0.05 | 14.0 | 3.41 | 0.09 | 0.77 | 0.06 | 03.5 |
| 6.04 | 72.0 | 2.75 | 0.13 | 1.07 | 0.09 | 67.0 | 2.61 | 0.17 | 1.06 | 0.12 | 05.0 |
| 6.05 | 39.5 | 3.45 | 0.12 | 1.25 | 0.09 | 34.5 | 3.17 | 0.16 | 1.25 | 0.12 | 05.0 |
| 6.06 | 07.0 | 3.90 | 0.09 | 0.97 | 0.06 | 06.5 | 3.53 | 0.12 | 0.99 | 0.08 | 00.5 |
| 6.07 | 63.5 | 3.16 | 0.14 | 1.20 | 0.10 | 60.0 | 2.84 | 0.16 | 1.07 | 0.11 | 03.5 |
| 6.08 | 39.5 | 3.45 | 0.10 | 1.00 | 0.07 | 36.5 | 3.14 | 0.13 | 0.96 | 0.09 | 03.0 |
| 6.09 | 43.0 | 3.39 | 0.11 | 1.01 | 0.07 | 36.5 | 3.14 | 0.14 | 1.04 | 0.10 | 06.5 |
| 6.10 | 73.0 | 2.74 | 0.14 | 1.20 | 0.10 | 72.5 | 2.53 | 0.14 | 0.99 | 0.10 | 00.5 |

MEAN RANK DIFFERENCE IS 5.7

## IMPORTANCE

| ITEM NO. | GRADUATE ITEM RANK | GRADUATE MEAN | GRADUATE S.E. MEAN | GRADUATE S.D. | GRADUATE S.E. S.D. | EMPLOYER ITEM RANK | EMPLOYER MEAN | EMPLOYER S.E. MEAN | EMPLOYER S.D. | EMPLOYER S.E. S.D. | RANK DIFF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 43.0 | 3.27 | 0.10 | 1.09 | 0.07 | 27.5 | 3.41 | 0.13 | 1.06 | 0.09 | 15.5 |
| 1.02 | 62.0 | 2.99 | 0.11 | 1.12 | 0.08 | 56.0 | 3.04 | 0.14 | 0.97 | 0.10 | 06.0 |
| 1.03 | 31.0 | 3.50 | 0.10 | 1.07 | 0.07 | 52.0 | 3.08 | 0.15 | 1.18 | 0.10 | 21.0 |
| 1.04 | 25.0 | 3.62 | 0.09 | 0.98 | 0.06 | 13.5 | 3.68 | 0.13 | 0.98 | 0.08 | 11.5 |
| 1.05 | 12.0 | 3.78 | 0.08 | 0.86 | 0.05 | 13.5 | 3.68 | 0.10 | 0.91 | 0.07 | 01.5 |
| 1.06 | 63.0 | 2.94 | 0.10 | 1.05 | 0.07 | 66.0 | 3.04 | 0.15 | 1.08 | 0.10 | 07.0 |
| 1.07 | 55.0 | 3.11 | 0.10 | 1.06 | 0.07 | 60.5 | 3.11 | 0.15 | 1.20 | 0.11 | 05.5 |
| 1.08 | 40.0 | 3.37 | 0.09 | 0.97 | 0.06 | 36.0 | 3.34 | 0.11 | 0.91 | 0.08 | 04.0 |
| 1.09 | 48.5 | 3.18 | 0.11 | 1.04 | 0.08 | 36.0 | 3.34 | 0.15 | 1.06 | 0.10 | 10.5 |
| 1.10 | 35.0 | 3.46 | 0.10 | 1.03 | 0.07 | 18.0 | 3.58 | 0.12 | 0.95 | 0.08 | 17.0 |
| 1.11 | 75.0 | 1.73 | 0.17 | 1.05 | 0.12 | 75.0 | 1.96 | 0.22 | 1.14 | 0.15 | 00.0 |
| 2.01 | 50.5 | 3.15 | 0.10 | 1.10 | 0.07 | 44.5 | 3.22 | 0.12 | 1.04 | 0.09 | 06.0 |
| 2.02 | 42.0 | 3.32 | 0.10 | 1.10 | 0.07 | 24.5 | 3.46 | 0.11 | 0.94 | 0.08 | 17.5 |
| 2.03 | 57.5 | 3.09 | 0.11 | 1.13 | 0.07 | 36.0 | 3.34 | 0.13 | 1.04 | 0.09 | 21.5 |
| 2.04 | 74.0 | 1.77 | 0.11 | 0.78 | 0.08 | 74.0 | 2.12 | 0.15 | 0.87 | 0.11 | 00.0 |
| 2.05 | 71.0 | 2.40 | 0.12 | 0 | 0.09 | 69.0 | 2.36 | 0.15 | 0.98 | 0.10 | 02.0 |
| 2.06 | 57.5 | 3.09 | 0.11 | 1.11 | 0.08 | 47.0 | 3.19 | 0.14 | 1.07 | 0.10 | 10.5 |
| 2.07 | 39.0 | 3.39 | 0.10 | 1.02 | 0.07 | 32.0 | 3.38 | 0.17 | 1.20 | 0.12 | 07.0 |
| 2.08 | 11.0 | 3.85 | 0.09 | 1.01 | 0.06 | 09.0 | 3.87 | 0.12 | 1.02 | 0.08 | 02.0 |
| 2.09 | 23.0 | 3.63 | 0.09 | 0.96 | 0.06 | 46.0 | 3.21 | 0.14 | 1.15 | 0.10 | 23.0 |
| 2.10 | 41.0 | 3.36 | 0.11 | 1.06 | 0.08 | 26.0 | 3.42 | 0.14 | 1.04 | 0.10 | 15.0 |
| 2.11 | 48.0 | 3.17 | 0.16 | 1.25 | 0.12 | 64.5 | 2.74 | 0.22 | 1.22 | 0.15 | 16.5 |
| 3.01 | 61.0 | 3.01 | 0.14 | 1.18 | 0.10 | 66.0 | 2.69 | 0.21 | 1.43 | 0.15 | 05.0 |
| 3.02 | 07.0 | 4.02 | 0.09 | 0.95 | 0.06 | 08.0 | 3.88 | 0.13 | 1.07 | 0.09 | 01.0 |
| 3.03 | 67.0 | 2.84 | 0.16 | 1.35 | 0.11 | 59.0 | 2.98 | 0.19 | 1.35 | 0.14 | 08.0 |
| 3.04 | 50.5 | 3.15 | 0.13 | 1.16 | 0.09 | 56.0 | 3.04 | 0.13 | 0.97 | 0.09 | 05.5 |
| 3.05 | 28.0 | 3.59 | 0.09 | 1.02 | 0.07 | 29.5 | 3.39 | 0.10 | 0.90 | 0.07 | 01.5 |
| 3.06 | 38.0 | 3.43 | 0.09 | 0.97 | 0.06 | 38.0 | 3.32 | 0.11 | 0.91 | 0.08 | 00.0 |
| 3.07 | 34.0 | 3.47 | 0.09 | 0.98 | 0.06 | 27.5 | 3.41 | 0.10 | 0.84 | 0.07 | 06.5 |
| 3.08 | 64.0 | 2.91 | 0.12 | 1.07 | 0.08 | 63.0 | 2.79 | 0.13 | 0.96 | 0.09 | 01.0 |
| 3.09 | 18.5 | 3.70 | 0.08 | 0.87 | 0.06 | 22.5 | 3.47 | 0.12 | 0.97 | 0.08 | 04.0 |
| 3.10 | 21.0 | 3.65 | 0.08 | 0.89 | 0.06 | 21.0 | 3.50 | 0.11 | 0.89 | 0.09 | 00.0 |
| 3.11 | 31.0 | 3.50 | 0.09 | 0.97 | 0.07 | 42.5 | 3.23 | 0.12 | 0.98 | 0.09 | 11.5 |
| 3.12 | 26.5 | 3.61 | 0.10 | 1.04 | 0.07 | 34.0 | 3.37 | 0.10 | 0.83 | 0.07 | 07.5 |
| 3.13 | 36.5 | 3.43 | 0.09 | 1.02 | 0.06 | 41.0 | 3.25 | 0.12 | 0.97 | 0.08 | 04.5 |
| 3.14 | 36.5 | 3.43 | 0.12 | 1.07 | 0.09 | 52.0 | 3.08 | 0.16 | 1.11 | 0.11 | 15.5 |
| 3.15 | 29.0 | 3.58 | 0.10 | 1.00 | 0.07 | 32.0 | 3.38 | 0.11 | 0.88 | 0.08 | 03.0 |
| 3.16 | 15.5 | 3.75 | 0.09 | 0.97 | 0.06 | 19.0 | 3.56 | 0.09 | 0.75 | 0.06 | 03.5 |
| 3.17 | 26.5 | 3.61 | 0.10 | 1.09 | 0.07 | 29.5 | 3.39 | 0.12 | 0.99 | 0.08 | 03.0 |
| 3.18 | 65.0 | 2.89 | 0.13 | 1.06 | 0.09 | 64.5 | 2.74 | 0.15 | 1.03 | 0.11 | 00.5 |
| 3.19 | 60.0 | 3.07 | 0.12 | 1.08 | 0.08 | 52.0 | 3.08 | 0.17 | 1.19 | 0.12 | 08.0 |
| 3.20 | 14.0 | 3.76 | 0.10 | 1.07 | 0.07 | 10.0 | 3.82 | 0.14 | 1.02 | 0.08 | 04.0 |
| 3.21 | 33.0 | 3.48 | 0.11 | 1.09 | 0.08 | 42.5 | 3.23 | 0.13 | 1.01 | 0.09 | 09.5 |
| 3.22 | 15.5 | 3.75 | 0.08 | 0.91 | 0.06 | 15.5 | 3.63 | 0.09 | 0.81 | 0.06 | 00.0 |
| 3.23 | 66.0 | 2.87 | 0.13 | 1.10 | 0.09 | 68.0 | 2.54 | 0.15 | 0.94 | 0.10 | 02.0 |
| 3.24 | 68.0 | 2.83 | 0.14 | 1.13 | 0.10 | 67.0 | 2.60 | 0.17 | 1.07 | 0.12 | 01.0 |
| 3.25 | 69.0 | 2.64 | 0.13 | 0.99 | 0.09 | 70.5 | 2.31 | 0.18 | 1.06 | 0.13 | 01.5 |
| 3.26 | 08.0 | 3.97 | 0.10 | 1.11 | 0.07 | 07.0 | 3.90 | 0.12 | 1.03 | 0.08 | 01.0 |
| 4.01 | 02.0 | 4.37 | 0.07 | 0.79 | 0.05 | 01.0 | 4.30 | 0.09 | 0.78 | 0.06 | 01.0 |
| 4.02 | 04.0 | 4.15 | 0.08 | 0.92 | 0.06 | 02.0 | 4.23 | 0.09 | 0.81 | 0.06 | 02.0 |
| 4.03 | 03.0 | 4.16 | 0.08 | 0.90 | 0.06 | 04.0 | 4.10 | 0.10 | 0.92 | 0.07 | 01.0 |
| 4.04 | 01.0 | 4.40 | 0.07 | 0.79 | 0.05 | 03.0 | 4.22 | 0.09 | 0.77 | 0.06 | 02.0 |
| 4.05 | 55.0 | 3.11 | 0.11 | 1.09 | 0.08 | 49.5 | 3.11 | 0.13 | 1.03 | 0.09 | 05.5 |
| 4.06 | 23.0 | 3.63 | 0.10 | 1.11 | 0.07 | 32.0 | 3.38 | 0.13 | 1.06 | 0.09 | 09.0 |
| 4.07 | 17.0 | 3.74 | 0.08 | 0.95 | 0.06 | 15.5 | 3.63 | 0.11 | 0.94 | 0.08 | 01.5 |
| 4.08 | 18.5 | 3.70 | 0.09 | 1.03 | 0.07 | 22.5 | 3.47 | 0.12 | 0.99 | 0.08 | 04.0 |
| 4.09 | 06.0 | 4.07 | 0.07 | 0.83 | 0.05 | 05.0 | 4.05 | 0.10 | 0.91 | 0.07 | 01.0 |
| 4.10 | 09.0 | 3.95 | 0.08 | 0.97 | 0.06 | 06.0 | 3.95 | 0.12 | 1.04 | 0.08 | 03.0 |
| 4.11 | 52.0 | 3.14 | 0.12 | 1.11 | 0.08 | 61.0 | 2.95 | 0.15 | 1.12 | 0.11 | 09.0 |
| 4.12 | 44.0 | 3.24 | 0.09 | 1.02 | 0.07 | 44.5 | 3.22 | 0.11 | 0.98 | 0.08 | 00.5 |
| 5.01 | 31.0 | 3.50 | 0.11 | 1.17 | 0.08 | 24.5 | 3.46 | 0.11 | 0.92 | 0.08 | 06.5 |
| 5.02 | 13.0 | 3.77 | 0.09 | 0.96 | 0.06 | 17.0 | 3.61 | 0.12 | 1.01 | 0.08 | 04.0 |
| 5.03 | 23.0 | 3.63 | 0.09 | 0.96 | 0.06 | 20.0 | 3.54 | 0.11 | 0.94 | 0.08 | 03.0 |
| 5.04 | 46.5 | 3.18 | 0.11 | 1.09 | 0.08 | 39.0 | 3.29 | 0.12 | 0.95 | 0.08 | 07.5 |
| 5.05 | 55.0 | 3.11 | 0.11 | 1.05 | 0.08 | 40.0 | 3.26 | 0.12 | 0.91 | 0.08 | 15.0 |
| 6.01 | 70.0 | 2.48 | 0.10 | 1.03 | 0.07 | 73.0 | 2.21 | 0.12 | 0.95 | 0.08 | 03.0 |
| 6.02 | 20.0 | 3.67 | 0.11 | 1.13 | 0.07 | 48.0 | 3.13 | 0.15 | 1.15 | 0.11 | 28.0 |
| 6.03 | 10.0 | 3.92 | 0.08 | 0.87 | 0.05 | 12.0 | 3.75 | 0.10 | 0.90 | 0.07 | 02.0 |
| 6.04 | 72.0 | 2.37 | 0.13 | 1.07 | 0.09 | 70.5 | 2.31 | 0.15 | 0.96 | 0.11 | 01.5 |
| 6.05 | 53.0 | 3.13 | 0.12 | 1.25 | 0.09 | 62.0 | 2.88 | 0.16 | 1.19 | 0.11 | 09.0 |
| 6.06 | 05.0 | 4.10 | 0.08 | 0.95 | 0.06 | 11.0 | 3.78 | 0.12 | 1.06 | 0.09 | 06.0 |
| 6.07 | 59.0 | 3.08 | 0.14 | 1.22 | 0.10 | 60.0 | 2.96 | 0.14 | 0.98 | 0.10 | 01.0 |
| 6.08 | 45.0 | 3.23 | 0.12 | 1.15 | 0.08 | 58.0 | 3.00 | 0.14 | 1.08 | 0.10 | 13.0 |
| 6.09 | 49.0 | 3.16 | 0.12 | 1.22 | 0.09 | 54.0 | 3.07 | 0.16 | 1.16 | 0.11 | 05.0 |
| 6.10 | 73.0 | 2.20 | 0.11 | 0.95 | 0.08 | 72.0 | 2.25 | 0.12 | 0.85 | 0.09 | 01.0 |

MEAN RANK DIFFERENCE IS 6.3

## FUTURE NEED

| ITEM NO. | GRADUATE ITEM RANK | GRADUATE MEAN | GRADUATE S.E. MEAN | GRADUATE S.D. | GRADUATE S.E. S.D. | EMPLOYER ITEM RANK | EMPLOYER MEAN | EMPLOYER S.E. MEAN | EMPLOYER S.D. | EMPLOYER S.E. S.D. | RANK DIFF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 20.0 | 3.67 | 0.09 | 1.03 | 0.06 | 09.0 | 3.69 | 0.13 | 1.11 | 0.09 | 11.0 |
| 1.02 | 49.0 | 3.30 | 0.10 | 1.07 | 0.07 | 43.0 | 3.22 | 0.14 | 1.26 | 0.10 | 06.0 |
| 1.03 | 11.5 | 3.77 | 0.08 | 0.94 | 0.06 | 19.0 | 3.56 | 0.12 | 1.04 | 0.08 | 07.5 |
| 1.04 | 26.0 | 3.57 | 0.08 | 0.96 | 0.06 | 10.5 | 3.68 | 0.10 | 0.91 | 0.07 | 15.5 |
| 1.05 | 14.0 | 3.71 | 0.07 | 0.86 | 0.05 | 13.0 | 3.64 | 0.08 | 0.73 | 0.06 | 01.0 |
| 1.06 | 44.5 | 3.33 | 0.09 | 0.99 | 0.06 | 46.0 | 3.14 | 0.12 | 1.06 | 0.09 | 01.5 |
| 1.07 | 59.5 | 3.02 | 0.09 | 0.98 | 0.06 | 60.0 | 2.87 | 0.12 | 1.03 | 0.08 | 00.5 |
| 1.08 | 42.0 | 3.35 | 0.07 | 0.75 | 0.05 | 41.0 | 3.28 | 0.11 | 0.95 | 0.08 | 01.0 |
| 1.09 | 52.0 | 3.18 | 0.08 | 0.91 | 0.06 | 55.0 | 2.99 | 0.12 | 1.06 | 0.09 | 03.0 |
| 1.10 | 37.0 | 3.48 | 0.08 | 0.90 | 0.06 | 28.5 | 3.47 | 0.12 | 1.05 | 0.09 | 08.5 |
| 1.11 | 75.0 | 1.77 | 0.10 | 1.03 | 0.07 | 75.0 | 1.87 | 0.13 | 1.10 | 0.09 | 00.0 |
| 2.01 | 50.0 | 3.28 | 0.08 | 0.93 | 0.06 | 50.0 | 3.08 | 0.11 | 0.92 | 0.07 | 00.0 |
| 2.02 | 39.0 | 3.42 | 0.09 | 1.00 | 0.06 | 44.0 | 3.21 | 0.11 | 0.94 | 0.08 | 05.0 |
| 2.03 | 54.0 | 3.13 | 0.09 | 1.07 | 0.07 | 53.5 | 3.01 | 0.12 | 1.02 | 0.08 | 00.5 |
| 2.04 | 74.0 | 2.04 | 0.09 | 0.95 | 0.06 | 74.0 | 2.32 | 0.12 | 0.99 | 0.08 | 00.0 |
| 2.05 | 71.0 | 2.52 | 0.10 | 1.05 | 0.07 | 68.0 | 2.64 | 0.12 | 1.03 | 0.09 | 03.0 |
| 2.06 | 47.5 | 3.31 | 0.11 | 1.23 | 0.08 | 36.0 | 3.34 | 0.13 | 1.11 | 0.09 | 11.5 |
| 2.07 | 08.5 | 3.79 | 0.10 | 1.09 | 0.07 | 08.0 | 3.71 | 0.13 | 1.13 | 0.09 | 00.5 |
| 2.08 | 08.5 | 3.79 | 0.08 | 0.93 | 0.06 | 02.0 | 3.81 | 0.10 | 0.86 | 0.07 | 06.5 |
| 2.09 | 33.5 | 3.51 | 0.07 | 0.85 | 0.05 | 24.0 | 3.49 | 0.10 | 0.86 | 0.07 | 09.5 |
| 2.10 | 44.5 | 3.33 | 0.09 | 1.00 | 0.06 | 30.0 | 3.40 | 0.12 | 1.03 | 0.09 | 14.5 |
| 2.11 | 67.0 | 2.75 | 0.11 | 1.23 | 0.08 | 63.0 | 2.76 | 0.14 | 1.10 | 0.10 | 04.0 |
| 3.01 | 66.0 | 2.79 | 0.11 | 1.16 | 0.07 | 69.0 | 2.62 | 0.14 | 1.23 | 0.10 | 03.0 |
| 3.02 | 07.0 | 3.80 | 0.09 | 1.00 | 0.06 | 03.5 | 3.79 | 0.11 | 0.94 | 0.08 | 03.5 |
| 3.03 | 69.0 | 2.63 | 0.12 | 1.29 | 0.08 | 59.0 | 2.89 | 0.14 | 1.19 | 0.10 | 10.0 |
| 3.04 | 57.0 | 3.07 | 0.10 | 1.15 | 0.07 | 64.5 | 2.74 | 0.12 | 1.02 | 0.08 | 07.5 |
| 3.05 | 24.0 | 3.63 | 0.08 | 0.94 | 0.06 | 35.0 | 3.35 | 0.09 | 0.80 | 0.06 | 11.0 |
| 3.06 | 37.0 | 3.48 | 0.08 | 0.91 | 0.06 | 34.0 | 3.36 | 0.08 | 0.68 | 0.06 | 03.0 |
| 3.07 | 37.0 | 3.48 | 0.08 | 0.89 | 0.06 | 31.5 | 3.39 | 0.08 | 0.69 | 0.06 | 05.5 |
| 3.08 | 61.0 | 3.00 | 0.09 | 0.95 | 0.06 | 58.0 | 2.92 | 0.11 | 0.90 | 0.07 | 03.0 |
| 3.09 | 30.0 | 3.54 | 0.09 | 0.98 | 0.06 | 40.0 | 3.30 | 0.09 | 0.76 | 0.06 | 10.0 |
| 3.10 | 27.0 | 3.56 | 0.09 | 1.01 | 0.06 | 33.0 | 3.37 | 0.10 | 0.83 | 0.07 | 06.0 |
| 3.11 | 30.0 | 3.54 | 0.09 | 1.03 | 0.06 | 31.5 | 3.39 | 0.09 | 0.81 | 0.07 | 01.5 |
| 3.12 | 41.0 | 3.36 | 0.10 | 1.08 | 0.07 | 53.5 | 3.01 | 0.10 | 0.85 | 0.07 | 12.5 |
| 3.13 | 59.5 | 3.02 | 0.09 | 1.06 | 0.07 | 62.0 | 2.78 | 0.08 | 0.71 | 0.06 | 02.5 |
| 3.14 | 15.0 | 3.70 | 0.10 | 1.11 | 0.07 | 01.0 | 3.83 | 0.11 | 0.91 | 0.08 | 14.0 |
| 3.15 | 22.5 | 3.64 | 0.08 | 0.95 | 0.06 | 19.0 | 3.56 | 0.10 | 0.87 | 0.07 | 03.5 |
| 3.16 | 17.0 | 3.69 | 0.08 | 0.88 | 0.05 | 24.0 | 3.49 | 0.08 | 0.72 | 0.06 | 07.0 |
| 3.17 | 22.5 | 3.64 | 0.09 | 1.05 | 0.07 | 26.5 | 3.48 | 0.10 | 0.89 | 0.07 | 04.0 |
| 3.18 | 53.0 | 3.14 | 0.09 | 1.03 | 0.07 | 47.0 | 3.13 | 0.12 | 1.01 | 0.08 | 06.0 |
| 3.19 | 56.0 | 3.09 | 0.10 | 1.11 | 0.07 | 52.0 | 3.05 | 0.12 | 1.04 | 0.09 | 04.0 |
| 3.20 | 10.0 | 3.78 | 0.08 | 0.96 | 0.06 | 10.5 | 3.68 | 0.09 | 0.82 | 0.07 | 00.5 |
| 3.21 | 40.0 | 3.43 | 0.10 | 1.09 | 0.07 | 38.0 | 3.32 | 0.10 | 0.88 | 0.07 | 02.0 |
| 3.22 | 17.0 | 3.69 | 0.08 | 0.96 | 0.06 | 22.0 | 3.53 | 0.08 | 0.71 | 0.06 | 05.0 |
| 3.23 | 64.0 | 2.88 | 0.09 | 1.05 | 0.07 | 67.0 | 2.67 | 0.11 | 0.94 | 0.08 | 03.0 |
| 3.24 | 63.0 | 2.93 | 0.10 | 1.06 | 0.07 | 56.0 | 2.97 | 0.13 | 1.10 | 0.09 | 07.0 |
| 3.25 | 68.0 | 2.65 | 0.09 | 0.98 | 0.06 | 70.0 | 2.57 | 0.12 | 1.01 | 0.09 | 02.0 |
| 3.26 | 33.5 | 3.51 | 0.08 | 0.97 | 0.06 | 38.0 | 3.32 | 0.10 | 0.83 | 0.07 | 04.5 |
| 4.01 | 02.0 | 3.96 | 0.08 | 0.91 | 0.06 | 07.0 | 3.74 | 0.10 | 0.86 | 0.07 | 05.0 |
| 4.02 | 03.0 | 3.93 | 0.08 | 0.88 | 0.05 | 03.5 | 3.79 | 0.09 | 0.85 | 0.07 | 00.5 |
| 4.03 | 19.0 | 3.68 | 0.08 | 0.97 | 0.06 | 19.0 | 3.56 | 0.10 | 0.91 | 0.07 | 00.0 |
| 4.04 | 01.0 | 3.99 | 0.08 | 0.91 | 0.06 | 05.0 | 3.77 | 0.09 | 0.84 | 0.07 | 04.0 |
| 4.05 | 55.0 | 3.10 | 0.09 | 1.00 | 0.06 | 51.0 | 3.07 | 0.11 | 0.91 | 0.07 | 04.0 |
| 4.06 | 30.0 | 3.54 | 0.09 | 1.01 | 0.06 | 45.0 | 3.18 | 0.11 | 0.97 | 0.08 | 15.0 |
| 4.07 | 25.0 | 3.62 | 0.08 | 0.89 | 0.05 | 26.5 | 3.48 | 0.08 | 0.74 | 0.06 | 01.5 |
| 4.08 | 32.0 | 3.53 | 0.08 | 0.91 | 0.06 | 42.0 | 3.27 | 0.10 | 0.84 | 0.07 | 10.0 |
| 4.09 | 04.5 | 3.89 | 0.07 | 0.86 | 0.05 | 06.0 | 3.75 | 0.09 | 0.83 | 0.07 | 01.5 |
| 4.10 | 17.0 | 3.69 | 0.08 | 0.92 | 0.06 | 13.0 | 3.64 | 0.10 | 0.91 | 0.07 | 04.0 |
| 4.11 | 47.5 | 3.31 | 0.10 | 1.07 | 0.07 | 48.5 | 3.11 | 0.11 | 0.94 | 0.08 | 01.0 |
| 4.12 | 28.0 | 3.55 | 0.08 | 0.93 | 0.06 | 24.0 | 3.49 | 0.09 | 0.77 | 0.06 | 04.0 |
| 5.01 | 21.0 | 3.66 | 0.09 | 0.99 | 0.06 | 13.0 | 3.64 | 0.11 | 0.97 | 0.08 | 08.0 |
| 5.02 | 06.0 | 3.84 | 0.07 | 0.87 | 0.05 | 17.0 | 3.58 | 0.10 | 0.89 | 0.07 | 11.0 |
| 5.03 | 13.0 | 3.75 | 0.08 | 0.90 | 0.06 | 15.0 | 3.63 | 0.10 | 0.86 | 0.07 | 02.0 |
| 5.04 | 43.0 | 3.34 | 0.09 | 1.03 | 0.06 | 28.5 | 3.47 | 0.10 | 0.86 | 0.07 | 14.5 |
| 5.05 | 51.0 | 3.22 | 0.09 | 0.97 | 0.06 | 38.0 | 3.32 | 0.11 | 0.96 | 0.08 | 13.0 |
| 6.01 | 72.0 | 2.41 | 0.09 | 1.00 | 0.06 | 72.0 | 2.44 | 0.11 | 0.91 | 0.07 | 00.0 |
| 6.02 | 35.0 | 3.50 | 0.10 | 1.11 | 0.07 | 57.0 | 2.95 | 0.13 | 1.16 | 0.10 | 22.0 |
| 6.03 | 11.5 | 3.77 | 0.08 | 0.87 | 0.05 | 16.0 | 3.59 | 0.08 | 0.75 | 0.06 | 04.5 |
| 6.04 | 70.0 | 2.58 | 0.10 | 1.11 | 0.07 | 73.0 | 2.42 | 0.14 | 1.12 | 0.10 | 03.0 |
| 6.05 | 65.0 | 2.84 | 0.11 | 1.24 | 0.08 | 66.0 | 2.69 | 0.11 | 0.98 | 0.08 | 01.0 |
| 6.06 | 04.5 | 3.89 | 0.09 | 1.03 | 0.06 | 21.0 | 3.55 | 0.11 | 0.98 | 0.08 | 16.5 |
| 6.07 | 46.0 | 3.32 | 0.12 | 1.28 | 0.08 | 48.5 | 3.11 | 0.15 | 1.26 | 0.10 | 02.5 |
| 6.08 | 58.0 | 3.06 | 0.10 | 1.08 | 0.07 | 61.0 | 2.84 | 0.11 | 0.95 | 0.08 | 03.0 |
| 6.09 | 62.0 | 2.97 | 0.11 | 1.18 | 0.08 | 64.5 | 2.74 | 0.12 | 0.99 | 0.08 | 02.5 |
| 6.10 | 73.0 | 2.28 | 0.09 | 1.00 | 0.06 | 71.0 | 2.48 | 0.11 | 0.97 | 0.08 | 02.0 |

MEAN RANK DIFFERENCE IS 5.4

APPENDIX P

RANKS FOR ALL TASKS BY DESCRIPTION

## FREQUENCY

| ITEM NO. | TASK DESCRIPTION | GRAD RANK | EMP RANK |
|---|---|---|---|
| 4.01 | READ A PROGRAM LISTING | 01.0 | 01.0 |
| 4.02 | DESK CHECK A PROGRAM | 02.0 | 02.0 |
| 3.26 | USE CODING SHEETS | 03.5 | 03.0 |
| 4.03 | CORRECT SYNTAX (CLERICAL) ERRORS | 03.5 | 04.0 |
| 6.06 | USE JOB CONTROL LANGUAGE (CONTROL CARDS) | 05.0 | 07.0 |
| 4.04 | CORRECT LOGICAL ERRORS | 06.0 | 05.0 |
| 1.05 | WORK WITH OTHER PROGRAMMERS ON PROBLEM | 07.0 | 09.0 |
| 1.01 | USE COMPANY SYSTEM STANDARDS | 08.0 | 17.5 |
| 2.09 | SELECT APPROPRIATE DATA NAMES FOR DATA | 09.0 | 22.0 |
| 4.09 | TEST PROGRAM USING TEST DATA | 10.0 | 06.0 |
| 6.03 | PERFORM PROGRAM MAINTENANCE | 11.0 | 10.5 |
| 3.20 | WRITE COMMENTS IN PROGRAM | 12.0 | 08.0 |
| 3.02 | WRITE HIGHER LEVEL LANGUAGE INSTRUCTIONS | 13.0 | 12.0 |
| 4.07 | READ A FILE DUMP | 14.5 | 13.5 |
| 4.08 | READ A CROSS-REFERENCE LISTING | 14.5 | 19.0 |
| 4.10 | TEST PROGRAM USING LIVE (USER) DATA | 16.0 | 15.0 |
| 3.16 | WRITE ERROR ROUTINES | 17.0 | 21.0 |
| 2.08 | PREPARE A TEST DATA FOR PROGRAMS | 18.0 | 13.5 |
| 1.04 | WORK WITH SYSTEMS ANALYST ON PROBLEM | 19.0 | 10.5 |
| 3.09 | WRITE SEQUENTIAL DISK FILE HANDLING ROUTINES | 20.0 | 25.0 |
| 3.22 | WRITE EDIT ROUTINES | 21.5 | 17.5 |
| 6.02 | PATCH COMPUTER PROGRAMS | 21.5 | 50.0 |
| 3.05 | USE DISK SORT UTILITY ROUTINES | 23.0 | 16.0 |
| 3.13 | USE CARD FILE HANDLING ROUTINES | 24.0 | 27.0 |
| 2.01 | USE STANDARD FLOWCHART SYMBOLS | 25.0 | 23.5 |
| 2.07 | USE STRUCTURED PROGRAMMING TECHNIQUES | 26.0 | 38.5 |
| 3.17 | USE LIBRARY ROUTINES | 27.0 | 20.0 |
| 3.07 | WRITE TABLE SEARCHING INSTRUCTIONS | 28.0 | 31.0 |
| 3.12 | USE TAPE FILE HANDLING ROUTINES | 29.0 | 32.0 |
| 3.06 | WRITE TABLE BUILDING INSTRUCTIONS | 30.0 | 34.0 |
| 5.02 | WRITE COMPUTER OPERATOR INSTRUCTIONS | 31.0 | 23.5 |
| 4.06 | READ A MEMORY DUMP | 32.0 | 30.0 |
| 3.10 | USE INDEX-SEQUENTIAL DISK FILE HANDLING ROUTINES | 33.0 | 29.0 |
| 1.08 | PREPARE A PRINTER SPACING FORM | 34.0 | 35.0 |
| 2.02 | PREPARE A GENERAL (LOGIC) PROGRAM FLOWCHART | 35.5 | 33.0 |
| 6.05 | OPERATE COMPUTER FOR PROGRAM TESTS | 35.5 | 42.5 |
| 1.03 | WORK WITH USERS ON PROBLEM | 37.0 | 40.0 |
| 5.03 | WRITE DOCUMENTATION UPDATES AFTER A PROGRAM REVISION | 38.0 | 26.0 |
| 4.12 | RECOMMEND CORRECTIONS OR MODIFICATIONS TO PROGRAMS | 39.0 | 28.0 |
| 3.15 | WRITE SUBROUTINES | 40.0 | 36.0 |
| 6.08 | PERFORM NUMBER SYSTEM ARITHMETIC | 41.0 | 38.5 |
| 3.21 | WRITE INSTRUCTIONS FOR INTERNAL/EXTERNAL CONTROLS | 42.0 | 37.0 |
| 3.11 | USE RANDOM DISK FILE HANDLING ROUTINES | 43.0 | 48.0 |
| 6.01 | KEYPUNCH PROGRAM | 44.0 | 47.0 |
| 1.10 | PREPARE A DISK RECORD LAYOUT | 45.0 | 45.0 |
| 6.09 | CONVERT NUMBERS BETWEEN NUMBER SYSTEMS | 46.0 | 51.0 |
| 2.10 | SELECT FILE ORGANIZATION & ACCESS METHODS FOR DATA FILES | 47.0 | 56.0 |
| 5.01 | PREPARE A PROGRAM DOCUMENTATION MANUAL | 48.0 | 41.0 |
| 1.07 | PREPARE A CARD RECORD LAYOUT | 49.0 | 52.0 |
| 2.03 | PREPARE A DETAIL PROGRAM FLOWCHART | 50.0 | 46.0 |
| 1.02 | WRITE A DETAILED DESCRIPTION OF A PROBLEM | 51.0 | 64.0 |
| 3.19 | USE MACROS | 52.0 | 55.0 |
| 5.04 | SUMMARIZE THE CONTROLS IN PROGRAM TO DETECT ERRORS | 53.5 | 42.5 |
| 6.07 | USE VIRTUAL STORAGE TECHNIQUES | 53.5 | 57.0 |
| 1.06 | PREPARE A SYSTEM FLOWCHART | 55.0 | 61.0 |
| 3.14 | USE DATA COMMUNICATIONS ROUTINES | 56.0 | 63.0 |
| 1.09 | PREPARE A TAPE RECORD LAYOUT | 57.5 | 58.0 |
| 4.05 | READ A TRACE | 57.5 | 44.0 |
| 2.06 | DIVIDE A PROGRAM INTO MODULES | 59.5 | 54.0 |
| 3.04 | USE TAPE SORT UTILITY ROUTINES | 59.5 | 53.0 |
| 5.05 | SUMMARIZE CALCULATIONS USED IN PROGRAM | 61.0 | 49.0 |
| 4.11 | EDIT PROGRAM FOR EFFECTIVE USE OF AUXILIARY STORAGE | 62.0 | 59.0 |
| 3.03 | WRITE REPORT PROGRAM GENERATOR LANGUAGE INSTRUCTIONS | 63.0 | 61.0 |
| 3.08 | WRITE TABLE SORTING INSTRUCTIONS | 64.0 | 61.0 |
| 3.01 | WRITE ASSEMBLER LANGUAGE INSTRUCTIONS | 65.0 | 65.0 |
| 3.23 | WRITE CHECK DIGIT CHECKING ROUTINES | 66.0 | 68.0 |
| 3.18 | WRITE LIBRARY ROUTINES | 67.0 | 66.0 |
| 2.11 | SELECT APPROPRIATE PROGRAMMING LANGUAGE FOR PROBLEM | 68.0 | 69.0 |
| 3.24 | WRITE CHECK POINT-RESTART INSTRUCTIONS | 69.0 | 70.0 |
| 3.25 | WRITE FORM TEST PATTERN ROUTINES | 70.0 | 73.0 |
| 6.04 | CONVERT A PROGRAM TO ANOTHER LANGUAGE | 71.0 | 74.0 |
| 6.10 | PREPARE PRINTER CARRIAGE TAPE | 72.0 | 71.0 |
| 2.05 | PREPARE A DECISION TABLE | 73.0 | 67.0 |
| 2.04 | PREPARE A GRID CHART | 74.0 | 72.0 |
| 1.11 | PREPARE A PAPER TAPE RECORD LAYOUT | 75.0 | 75.0 |

| ITEM NO. | TASK DESCRIPTION | GRAD RANK | EMP RANK |
|---|---|---|---|
| 3.26 | USE CODING SHEETS | 01.0 | 01.0 |
| 4.01 | READ A PROGRAM LISTING | 02.0 | 02.0 |
| 4.03 | CORRECT SYNTAX (CLERICAL) ERRORS | 03.0 | 03.0 |
| 4.04 | CORRECT LOGICAL ERRORS | 04.0 | 06.5 |
| 4.02 | DESK CHECK A PROGRAM | 05.0 | 05.0 |
| 3.20 | WRITE COMMENTS IN PROGRAM | 06.0 | 12.5 |
| 6.06 | USE JOB CONTROL LANGUAGE (CONTROL CARDS) | 07.0 | 06.5 |
| 4.08 | READ A CROSS-REFERENCE LISTING | 08.5 | 12.0 |
| 4.09 | TEST PROGRAM USING TEST DATA | 08.5 | 04.0 |
| 2.09 | SELECT APPROPRIATE DATA NAMES FOR DATA | 10.0 | 27.0 |
| 3.16 | WRITE ERROR ROUTINES | 11.0 | 27.0 |
| 3.02 | WRITE HIGHER LEVEL LANGUAGE INSTRUCTIONS | 12.0 | 16.0 |
| 3.05 | USE DISK SORT UTILITY ROUTINES | 14.0 | 16.0 |
| 3.09 | WRITE SEQUENTIAL DISK FILE HANDLING ROUTINES | 14.0 | 09.0 |
| 3.13 | USE CARD FILE HANDLING ROUTINES | 16.0 | 18.0 |
| 4.10 | TEST PROGRAM USING LIVE (USER) DATA | 16.0 | 12.0 |
| 4.07 | READ A FILE DUMP | 17.5 | 23.0 |
| 6.03 | PERFORM PROGRAM MAINTENANCE | 17.5 | 14.0 |
| 1.05 | WORK WITH OTHER PROGRAMMERS ON PROBLEM | 19.5 | 09.0 |
| 1.08 | PREPARE A PRINTER SPACING FORM | 19.5 | 19.5 |
| 2.08 | PREPARE A TEST DATA FOR PROGRAMS | 21.5 | 16.0 |
| 3.22 | WRITE EDIT ROUTINES | 21.5 | 19.5 |
| 2.01 | USE STANDARD FLOWCHART SYMBOLS | 24.0 | 23.0 |
| 2.02 | PREPARE A GENERAL (LOGIC) PROGRAM FLOWCHART | 24.0 | 34.5 |
| 3.12 | USE TAPE FILE HANDLING ROUTINES | 24.0 | 09.0 |
| 1.10 | PREPARE A DISK RECORD LAYOUT | 26.0 | 31.0 |
| 3.07 | WRITE TABLE SEARCHING INSTRUCTIONS | 27.5 | 25.0 |
| 3.17 | USE LIBRARY ROUTINES | 27.5 | 23.0 |
| 3.06 | WRITE TABLE BUILDING INSTRUCTIONS | 29.0 | 31.0 |
| 1.07 | PREPARE A CARD RECORD LAYOUT | 31.0 | 21.0 |
| 2.03 | PREPARE A DETAIL PROGRAM FLOWCHART | 31.0 | 42.0 |
| 5.02 | WRITE COMPUTER OPERATOR INSTRUCTIONS | 31.0 | 39.0 |
| 3.15 | WRITE SUBROUTINES | 33.0 | 40.5 |
| 3.10 | USE INDEX-SEQUENTIAL DISK FILE HANDLING ROUTINES | 34.0 | 27.0 |
| 2.07 | USE STRUCTURED PROGRAMMING TECHNIQUES | 35.0 | 44.0 |
| 6.02 | PATCH COMPUTER PROGRAMS | 36.0 | 31.0 |
| 1.09 | PREPARE A TAPE RECORD LAYOUT | 37.0 | 33.0 |
| 5.03 | WRITE DOCUMENTATION UPDATES AFTER A PROGRAM REVISION | 38.0 | 43.0 |
| 6.05 | OPERATE COMPUTER FOR PROGRAM TESTS | 39.5 | 34.5 |
| 6.08 | PERFORM NUMBER SYSTEM ARITHMETIC | 39.5 | 36.5 |
| 3.21 | WRITE INSTRUCTIONS FOR INTERNAL/EXTERNAL CONTROLS | 41.0 | 60.0 |
| 3.04 | USE TAPE SORT UTILITY ROUTINES | 42.0 | 38.0 |
| 6.09 | CONVERT NUMBERS BETWEEN NUMBER SYSTEMS | 43.0 | 36.5 |
| 1.04 | WORK WITH SYSTEMS ANALYST ON PROBLEM | 44.5 | 40.5 |
| 3.11 | USE RANDOM DISK FILE HANDLING ROUTINES | 44.5 | 47.0 |
| 1.01 | USE COMPANY SYSTEM STANDARDS | 46.0 | 51.0 |
| 4.06 | READ A MEMORY DUMP | 47.0 | 58.0 |
| 2.11 | SELECT APPROPRIATE PROGRAMMING LANGUAGE FOR PROBLEM | 48.0 | 60.0 |
| 6.01 | KEYPUNCH PROGRAM | 49.0 | 29.0 |
| 4.12 | RECOMMEND CORRECTIONS OR MODIFICATIONS TO PROGRAMS | 50.5 | 45.0 |
| 5.01 | PREPARE A PROGRAM DOCUMENTATION MANUAL | 50.5 | 47.0 |
| 1.03 | WORK WITH USERS ON PROBLEM | 52.0 | 63.0 |
| 4.05 | READ A TRACE | 53.0 | 57.0 |
| 3.14 | USE DATA COMMUNICATIONS ROUTINES | 55.0 | 72.5 |
| 5.04 | SUMMARIZE THE CONTROLS IN PROGRAM TO DETECT ERRORS | 55.0 | 49.5 |
| 5.05 | SUMMARIZE CALCULATIONS USED IN PROGRAM | 55.0 | 53.0 |
| 1.06 | PREPARE A SYSTEM FLOWCHART | 57.5 | 47.0 |
| 2.10 | SELECT FILE ORGANIZATION & ACCESS METHODS FOR DATA FILES | 57.5 | 55.0 |
| 2.06 | DIVIDE A PROGRAM INTO MODULES | 59.0 | 49.5 |
| 3.19 | USE MACROS | 60.0 | 53.0 |
| 3.08 | WRITE TABLE SORTING INSTRUCTIONS | 61.5 | 56.0 |
| 4.11 | EDIT PROGRAM FOR EFFECTIVE USE OF AUXILIARY STORAGE | 61.5 | 62.0 |
| 3.23 | WRITE CHECK DIGIT CHECKING ROUTINES | 63.5 | 68.0 |
| 6.07 | USE VIRTUAL STORAGE TECHNIQUES | 63.5 | 60.0 |
| 3.01 | WRITE ASSEMBLER LANGUAGE INSTRUCTIONS | 65.0 | 64.0 |
| 3.03 | WRITE REPORT PROGRAM GENERATOR LANGUAGE INSTRUCTIONS | 66.0 | 53.0 |
| 3.18 | WRITE LIBRARY ROUTINES | 67.0 | 65.0 |
| 3.25 | WRITE FORM TEST PATTERN ROUTINES | 68.0 | 70.0 |
| 1.02 | WRITE A DETAILED DESCRIPTION OF A PROBLEM | 69.0 | 66.0 |
| 3.24 | WRITE CHECK POINT-RESTART INSTRUCTIONS | 70.0 | 74.0 |
| 2.05 | PREPARE A DECISION TABLE | 71.0 | 69.0 |
| 6.04 | CONVERT A PROGRAM TO ANOTHER LANGUAGE | 72.0 | 67.0 |
| 6.10 | PREPARE PRINTER CARRIAGE TAPE | 73.0 | 72.5 |
| 2.04 | PREPARE A GRID CHART | 74.0 | 71.0 |
| 1.11 | PREPARE A PAPER TAPE RECORD LAYOUT | 75.0 | 75.0 |

## IMPORTANCE

| ITEM NO. | TASK DESCRIPTION | GRAD RANK | EMP RANK |
|---|---|---|---|
| 4.04 | CORRECT LOGICAL ERRORS | 01.0 | 03.0 |
| 4.01 | READ A PROGRAM LISTING | 02.0 | 01.0 |
| 4.03 | CORRECT SYNTAX (CLERICAL) ERRORS | 03.0 | 04.0 |
| 4.02 | DESK CHECK A PROGRAM | 04.0 | 02.0 |
| 6.06 | USE JOB CONTROL LANGUAGE (CONTROL CARDS) | 05.0 | 11.0 |
| 4.09 | TEST PROGRAM USING TEST DATA | 06.0 | 05.0 |
| 3.02 | WRITE HIGHER LEVEL LANGUAGE INSTRUCTIONS | 07.0 | 08.0 |
| 3.26 | USE CODING SHEETS | 08.0 | 07.0 |
| 4.10 | TEST PROGRAM USING LIVE (USER) DATA | 09.0 | 06.0 |
| 6.03 | PERFORM PROGRAM MAINTENANCE | 10.0 | 12.0 |
| 2.08 | PREPARE A TEST DATA FOR PROGRAMS | 11.0 | 09.0 |
| 1.05 | WORK WITH OTHER PROGRAMMERS ON PROBLEM | 12.0 | 13.5 |
| 5.02 | WRITE COMPUTER OPERATOR INSTRUCTIONS | 13.0 | 17.0 |
| 3.20 | WRITE COMMENTS IN PROGRAM | 14.0 | 10.0 |
| 3.16 | WRITE ERROR ROUTINES | 15.5 | 19.0 |
| 3.22 | WRITE EDIT ROUTINES | 15.5 | 15.5 |
| 4.07 | READ A FILE DUMP | 17.0 | 15.5 |
| 3.09 | WRITE SEQUENTIAL DISK FILE HANDLING ROUTINES | 18.5 | 22.5 |
| 4.08 | READ A CROSS-REFERENCE LISTING | 18.5 | 22.5 |
| 6.02 | PATCH COMPUTER PROGRAMS | 20.0 | 48.0 |
| 3.10 | USE INDEX-SEQUENTIAL DISK FILE HANDLING ROUTINES | 21.0 | 21.0 |
| 2.09 | SELECT APPROPRIATE DATA NAMES FOR DATA | 23.0 | 46.0 |
| 4.06 | READ A MEMORY DUMP | 23.0 | 32.0 |
| 5.03 | WRITE DOCUMENTATION UPDATES AFTER A PROGRAM REVISION | 23.0 | 20.0 |
| 1.04 | WORK WITH SYSTEMS ANALYST ON PROBLEM | 25.0 | 13.5 |
| 3.12 | USE TAPE FILE HANDLING ROUTINES | 26.5 | 34.0 |
| 3.17 | USE LIBRARY ROUTINES | 26.5 | 29.5 |
| 3.05 | USE DISK SORT UTILITY ROUTINES | 28.0 | 29.5 |
| 3.15 | WRITE SUBROUTINES | 29.0 | 32.0 |
| 1.03 | WORK WITH USERS ON PROBLEM | 31.0 | 52.0 |
| 3.11 | USE RANDOM DISK FILE HANDLING ROUTINES | 31.0 | 42.5 |
| 5.01 | PREPARE A PROGRAM DOCUMENTATION MANUAL | 33.0 | 24.5 |
| 3.21 | WRITE INSTRUCTIONS FOR INTERNAL/EXTERNAL CONTROLS | 34.0 | 42.5 |
| 3.07 | WRITE TABLE SEARCHING INSTRUCTIONS | 35.0 | 27.5 |
| 1.10 | PREPARE A DISK RECORD LAYOUT | 36.5 | 18.0 |
| 3.13 | USE CARD FILE HANDLING ROUTINES | 36.5 | 41.0 |
| 3.14 | USE DATA COMMUNICATIONS ROUTINES | 38.0 | 52.0 |
| 3.06 | WRITE TABLE BUILDING INSTRUCTIONS | 39.0 | 38.0 |
| 2.07 | USE STRUCTURED PROGRAMMING TECHNIQUES | 40.0 | 32.0 |
| 1.08 | PREPARE A PRINTER SPACING FORM | 41.0 | 36.0 |
| 2.10 | SELECT FILE ORGANIZATION & ACCESS METHODS FOR DATA FILES | 42.0 | 26.0 |
| 2.02 | PREPARE A GENERAL (LOGIC) PROGRAM FLOWCHART | 43.0 | 24.5 |
| 1.01 | USE COMPANY SYSTEM STANDARDS | 44.0 | 27.5 |
| 4.12 | RECOMMEND CORRECTIONS OR MODIFICATIONS TO PROGRAMS | 45.0 | 44.5 |
| 6.08 | PERFORM NUMBER SYSTEM ARITHMETIC | 46.5 | 58.0 |
| 1.09 | PREPARE A TAPE RECORD LAYOUT | 46.5 | 36.0 |
| 5.04 | SUMMARIZE THE CONTROLS IN PROGRAM TO DETECT ERRORS | 48.0 | 39.0 |
| 2.11 | SELECT APPROPRIATE PROGRAMMING LANGUAGE FOR PROBLEM | 49.0 | 64.5 |
| 6.09 | CONVERT NUMBERS BETWEEN NUMBER SYSTEMS | 50.5 | 54.0 |
| 2.01 | USE STANDARD FLOWCHART SYMBOLS | 50.5 | 44.5 |
| 3.04 | USE TAPE SORT UTILITY ROUTINES | 52.0 | 56.0 |
| 4.11 | EDIT PROGRAM FOR EFFECTIVE USE OF AUXILIARY STORAGE | 53.0 | 61.0 |
| 6.05 | OPERATE COMPUTER FOR PROGRAM TESTS | 55.0 | 62.0 |
| 1.07 | PREPARE A CARD RECORD LAYOUT | 55.0 | 49.5 |
| 4.05 | READ A TRACE | 55.0 | 49.5 |
| 5.05 | SUMMARIZE CALCULATIONS USED IN PROGRAM | 57.5 | 40.0 |
| 2.03 | PREPARE A DETAIL PROGRAM FLOWCHART | 57.5 | 36.0 |
| 2.06 | DIVIDE A PROGRAM INTO MODULES | 59.0 | 47.0 |
| 6.07 | USE VIRTUAL STORAGE TECHNIQUES | 60.0 | 60.0 |
| 3.19 | USE MACROS | 61.0 | 52.0 |
| 3.01 | WRITE ASSEMBLER LANGUAGE INSTRUCTIONS | 62.0 | 66.0 |
| 1.02 | WRITE A DETAILED DESCRIPTION OF A PROBLEM | 63.0 | 56.0 |
| 1.06 | PREPARE A SYSTEM FLOWCHART | 64.0 | 63.0 |
| 3.08 | WRITE TABLE SORTING INSTRUCTIONS | 65.0 | 64.5 |
| 3.18 | WRITE LIBRARY ROUTINES | 66.0 | 68.0 |
| 3.23 | WRITE CHECK DIGIT CHECKING ROUTINES | 67.0 | 59.0 |
| 3.03 | WRITE REPORT PROGRAM GENERATOR LANGUAGE INSTRUCTIONS | 68.0 | 67.0 |
| 3.24 | WRITE CHECK POINT-RESTART INSTRUCTIONS | 69.0 | 70.5 |
| 3.25 | WRITE FORM TEST PATTERN ROUTINES | 70.0 | 73.0 |
| 6.01 | KEYPUNCH PROGRAM | 71.0 | 69.0 |
| 2.05 | PREPARE A DECISION TABLE | 72.0 | 70.5 |
| 6.04 | CONVERT A PROGRAM TO ANOTHER LANGUAGE | 73.0 | 72.0 |
| 6.10 | PREPARE PRINTER CARRIAGE TAPE | 74.0 | 74.0 |
| 2.04 | PREPARE A GRID CHART | 75.0 | 75.0 |
| 1.11 | PREPARE A PAPER TAPE RECORD LAYOUT | | |

## FUTURE NEED

| ITEM NO. | TASK DESCRIPTION | GRAD RANK | EMP RANK |
|---|---|---|---|
| 4.04 | CORRECT LOGICAL ERRORS | 01.0 | 05.0 |
| 4.01 | READ A PROGRAM LISTING | 02.0 | 07.0 |
| 4.02 | DESK CHECK A PROGRAM | 03.0 | 03.5 |
| 4.09 | TEST PROGRAM USING TEST DATA | 04.5 | 06.0 |
| 6.06 | USE JOB CONTROL LANGUAGE (CONTROL CARDS) | 04.5 | 21.0 |
| 5.02 | WRITE COMPUTER OPERATOR INSTRUCTIONS | 06.0 | 17.0 |
| 3.02 | WRITE HIGHER LEVEL LANGUAGE INSTRUCTIONS | 07.0 | 03.5 |
| 2.07 | USE STRUCTURED PROGRAMMING TECHNIQUES | 08.5 | 08.0 |
| 2.08 | PREPARE A TEST DATA FOR PROGRAMS | 08.5 | 02.0 |
| 3.20 | WRITE COMMENTS IN PROGRAM | 10.0 | 10.5 |
| 1.03 | WORK WITH USERS ON PROBLEM | 11.5 | 19.0 |
| 6.03 | PERFORM PROGRAM MAINTENANCE | 11.5 | 16.0 |
| 5.03 | WRITE DOCUMENTATION UPDATES AFTER A PROGRAM REVISION | 13.0 | 15.0 |
| 1.05 | WORK WITH OTHER PROGRAMMERS ON PROBLEM | 14.0 | 13.0 |
| 3.14 | USE DATA COMMUNICATIONS ROUTINES | 15.0 | 01.0 |
| 3.16 | WRITE ERROR ROUTINES | 17.0 | 24.0 |
| 3.22 | WRITE EDIT ROUTINES | 17.0 | 22.0 |
| 4.10 | TEST PROGRAM USING LIVE (USER) DATA | 17.0 | 13.0 |
| 4.03 | CORRECT SYNTAX (CLERICAL) ERRORS | 19.0 | 19.0 |
| 1.01 | USE COMPANY SYSTEM STANDARDS | 20.0 | 09.0 |
| 5.01 | PREPARE A PROGRAM DOCUMENTATION MANUAL | 21.0 | 13.0 |
| 3.15 | WRITE SUBROUTINES | 22.5 | 19.0 |
| 3.17 | USE LIBRARY ROUTINES | 22.5 | 26.5 |
| 3.05 | USE DISK SORT UTILITY ROUTINES | 24.0 | 35.0 |
| 4.07 | READ A FILE DUMP | 25.0 | 26.5 |
| 1.04 | WORK WITH SYSTEMS ANALYST ON PROBLEM | 26.0 | 10.5 |
| 3.10 | USE INDEX-SEQUENTIAL DISK FILE HANDLING ROUTINES | 27.0 | 33.0 |
| 4.12 | RECOMMEND CORRECTIONS OR MODIFICATIONS TO PROGRAMS | 28.0 | 24.0 |
| 3.09 | WRITE SEQUENTIAL DISK FILE HANDLING ROUTINES | 30.0 | 40.0 |
| 3.11 | USE RANDOM DISK FILE HANDLING ROUTINES | 30.0 | 31.5 |
| 4.06 | READ A MEMORY DUMP | 30.0 | 45.0 |
| 4.08 | READ A CROSS-REFERENCE LISTING | 32.0 | 42.0 |
| 2.09 | SELECT APPROPRIATE DATA NAMES FOR DATA | 33.5 | 24.0 |
| 3.26 | USE CODING SHEETS | 33.5 | 38.0 |
| 6.02 | PATCH COMPUTER PROGRAMS | 35.0 | 37.0 |
| 1.10 | PREPARE A DISK RECORD LAYOUT | 37.0 | 28.5 |
| 3.06 | WRITE TABLE BUILDING INSTRUCTIONS | 37.0 | 34.0 |
| 3.07 | WRITE TABLE SEARCHING INSTRUCTIONS | 37.0 | 31.5 |
| 2.02 | PREPARE A GENERAL (LOGIC) PROGRAM FLOWCHART | 39.0 | 44.0 |
| 3.21 | WRITE INSTRUCTIONS FOR INTERNAL/EXTERNAL CONTROLS | 40.0 | 38.0 |
| 3.12 | USE TAPE FILE HANDLING ROUTINES | 41.0 | 53.5 |
| 1.08 | PREPARE A PRINTER SPACING FORM | 42.0 | 41.0 |
| 5.04 | SUMMARIZE THE CONTROLS IN PROGRAM TO DETECT ERRORS | 43.0 | 28.5 |
| 1.06 | PREPARE A SYSTEM FLOWCHART | 44.5 | 46.0 |
| 2.10 | SELECT FILE ORGANIZATION & ACCESS METHODS FOR DATA FILES | 44.5 | 30.0 |
| 6.07 | USE VIRTUAL STORAGE TECHNIQUES | 46.0 | 48.5 |
| 2.06 | DIVIDE A PROGRAM INTO MODULES | 47.5 | 36.0 |
| 4.11 | EDIT PROGRAM FOR EFFECTIVE USE OF AUXILIARY STORAGE | 47.5 | 48.5 |
| 1.02 | WRITE A DETAILED DESCRIPTION OF A PROBLEM | 49.0 | 43.0 |
| 2.01 | USE STANDARD FLOWCHART SYMBOLS | 50.0 | 50.0 |
| 5.05 | SUMMARIZE CALCULATIONS USED IN PROGRAM | 51.0 | 38.0 |
| 1.09 | PREPARE A TAPE RECORD LAYOUT | 52.0 | 55.0 |
| 3.18 | WRITE LIBRARY ROUTINES | 53.0 | 47.0 |
| 2.03 | PREPARE A DETAIL PROGRAM FLOWCHART | 54.0 | 53.5 |
| 4.05 | READ A TRACE | 55.0 | 51.0 |
| 3.19 | USE MACROS | 56.0 | 52.0 |
| 3.04 | USE TAPE SORT UTILITY ROUTINES | 57.0 | 64.5 |
| 6.08 | PERFORM NUMBER SYSTEM ARITHMETIC | 58.0 | 61.0 |
| 1.07 | PREPARE A CARD RECORD LAYOUT | 59.5 | 60.0 |
| 3.13 | USE CARD FILE HANDLING ROUTINES | 59.5 | 62.0 |
| 3.08 | WRITE TABLE SORTING INSTRUCTIONS | 61.0 | 58.0 |
| 6.09 | CONVERT NUMBERS BETWEEN NUMBER SYSTEMS | 62.0 | 64.5 |
| 3.24 | WRITE CHECK POINT-RESTART INSTRUCTIONS | 63.0 | 56.0 |
| 3.23 | WRITE CHECK DIGIT CHECKING ROUTINES | 64.0 | 67.0 |
| 6.05 | OPERATE COMPUTER FOR PROGRAM TESTS | 65.0 | 66.0 |
| 3.01 | WRITE ASSEMBLER LANGUAGE INSTRUCTIONS | 66.0 | 69.0 |
| 2.11 | SELECT APPROPRIATE PROGRAMMING LANGUAGE FOR PROBLEM | 67.0 | 63.0 |
| 3.25 | WRITE FORM TEST PATTERN ROUTINES | 68.0 | 70.0 |
| 3.03 | WRITE REPORT PROGRAM GENERATOR LANGUAGE INSTRUCTIONS | 69.0 | 59.0 |
| 6.04 | CONVERT A PROGRAM TO ANOTHER LANGUAGE | 70.0 | 73.0 |
| 2.05 | PREPARE A DECISION TABLE | 71.0 | 68.0 |
| 6.01 | KEYPUNCH PROGRAM | 72.0 | 72.0 |
| 6.10 | PREPARE PRINTER CARRIAGE TAPE | 73.0 | 71.0 |
| 2.04 | PREPARE A GRID CHART | 74.0 | 74.0 |
| 1.11 | PREPARE A PAPER TAPE RECORD LAYOUT | 75.0 | 75.0 |

APPENDIX Q

LETTER FROM RESPONDENT

February 19, 1976

Dear Sir:

I am filling out this form for two of my employees. I have answered these questions assuming the entry-level programmer was hired upon graduation. My answers would have been more optimistic if this programmer had gone through operations first. I am a former graduate of then K.I.T., and started as a computer operator. It has benefited me and all others who entered operations as an entry to programming.

I wish the teachers would stress the importance of a good computer background. The background I am speaking of is the contact with the computer, the test procedures, the operator instructions, the data network, the user contact and the scheduling and flow of work across the computer.

I believe the teachers are advocating immediate entry into programming from school, as my last search for prospective computer operators at Gateway was fruitless. This was very discouraging as our salary and benefit program, along with the opportunity for advancement, is very adequate.

I, as programming supervisor, can attest to a good operations background.

Thank you,

Boyd Klofenstine

sb

DE 010 174